Mississippi Valley Division,
Regional Planning and Environment Division South

South Central Coast Louisiana

Final Supplemental Integrated Feasibility Study with Environmental Impact Statement

Hurricane Ike flooding in Delcambre, Louisiana 2008.

May 2022

DISCLAIMER:

The recommendations herein reflect the information available at the time and current Department of the Army policies governing the formulation of individual projects. They do not reflect programming and budgeting priorities inherent in the formulation of national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to Congress as proposals for implementing funding. However, prior to the transmission to Congress, the state, Federal agencies and other parties will be advised of any modifications and afforded the opportunity to comment.

Cover Sheet

South Central Coast Final Supplemental Integrated Feasibility Study with Environmental Impact Statement
Lead Agency: Department of the Army
U.S. Army Corps of Engineers, New Orleans District
Cooperating Agencies: U.S. Fish and Wildlife Service, Federal Emergency Management Agency

Abstract:

The Louisiana parishes of St. Mary, St. Martin, and Iberia have high levels of risk and vulnerability to coastal storms, which is exacerbated by a combination of sea level rise and climate change over the study period. The study area is low in elevation, when combined with other factors such as the area's proximity to the Gulf of Mexico, subsiding lands, and rising seas, contribute to an increased risk of coastal flooding, shoreline erosion, and loss of wetlands. The people, economy, environment, and cultural heritage of coastal areas in South Central Louisiana are at risk from recurring damages caused by hurricane and storm surge flooding.

The South Central Coast Louisiana (SCCL) integrated feasibility study's purpose is to investigate potential structural and nonstructural solution sets in terms of coastal storm risk management (CSRM). CSRM addresses coastal storm flood risk to vulnerable populations, property, ecosystems, and infrastructure along the coast.

The U.S. Army Corps of Engineers, Mississippi Valley Division, New Orleans District (USACE) developed hurricane and storm damage risk reduction measures and screened those using preliminary costs and benefits to identify a focused array of National Economic Development (NED) alternatives. In addition to the No Action Alternative, two nonstructural alternatives were evaluated.

The USACE's Recommended Plan (RP) would reduce coastal storm risk for all eligible structures in the study area with a first floor elevation at or below the 0.04 annual exceedance probability (25 year stage) based on predicted year 2025 hydrologic conditions. The RP would reduce the risk of flood damage for a total of 2,240 structures comprised of 1,790 residential structures, 233 commercial structures, 32 public buildings, and 185 warehouses. The estimated fully funded total project cost (fully funded) for the NED RP is $1,334,413,000. The estimated project first cost is $914,769,000 at a fiscal year (FY) 2022 price level.

For further information on this statement, please contact

Mr. Joe Jordan
U.S. Army Corps of Engineers
Clock Tower Building, P.O. Box 2004
Rock Island, IL 61204-2004
Telephone: [redacted]
E-mail: [redacted]

CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

Executive Summary

This report describes the RP for the SCCL Final Integrated Feasibility Study and Environmental Impact Statement.

The people, economy, environment, and cultural heritage of coastal areas in South Central Louisiana are at risk from damages caused by hurricane, storm surge flooding, and wave action. Louisiana's south central coast topography and low elevation, proximity to the Gulf of Mexico, subsiding lands, and rising seas, are all contributing factors that cause coastal flooding, shoreline erosion, saltwater intrusion, and loss of wetland and marsh habitats, which are conditions that are expected to continue to worsen and further reduce the natural resiliency of the study area.

Congress authorized the investigation of alternatives to provide hurricane and storm damage risk reduction in St. Martin, St. Mary and Iberia Parishes in south central Louisiana. Planning to address hurricane and storm surge risk reduction (the NED component) was primarily focused on communities and areas located north of the Gulf Intracoastal Waterway (GIWW), but measures for all at-risk structures, both inside and outside of the coastal zone, were considered.

The SCCL study area encompasses over 2,966 square miles of varying terrain in the full extents of St. Martin, St. Mary, and Iberia Parishes (Figure ES-1). The majority of the study area borders Vermilion and West Cote Blanch Bays, both adjacent to the Gulf of Mexico. The major physiographic divisions are the gulf coast prairie and the gulf coast marsh. Bayou Teche and Vermilion can be considered two sub-basins in the combined Teche-Vermilion system. The Atchafalaya and Teche-Vermilion Basins contain the dominant hydrologic features, while the western portions of the Lower Grand and Terrebonne Basins are marginally relevant.

The GIWW is a man-made channel in the study area. The GIWW is the longest man-made channel crossing the study area and generally runs along the state's coastal zone boundary. Bayou Teche is another significant waterway within the study area. The Bayou Teche was a free flowing river channel lobe; it is navigable and prone to backwater flooding in certain events. The channels and waterways, except for the GIWW, are oriented north to south along the gulf coast.

Key federally-authorized water control structures in the study area include 10 pump stations, Calumet Floodgate East and West, Charenton Floodgate, Bayou Chene, and multiple barge gates at existing navigation channels. Key flood risk reduction systems include Bayou Sale, levees West of Berwick, Morgan City Backwater levees, Wax Lake outlet levees, West Atchafalaya Protection Levee, and East Atchafalaya Protection Levee. Further details on existing relevant infrastructure within the study area can be found in Appendix B: Engineering. Key highways in the study area are Interstate 10 and Highway-90. Population centers are mainly north of the GIWW, and the largest include the municipalities of Morgan City, Delcambre, and St. Martinville.

Flood risk management infrastructure in the study area is shown on Figure ES-1 and ES-2.

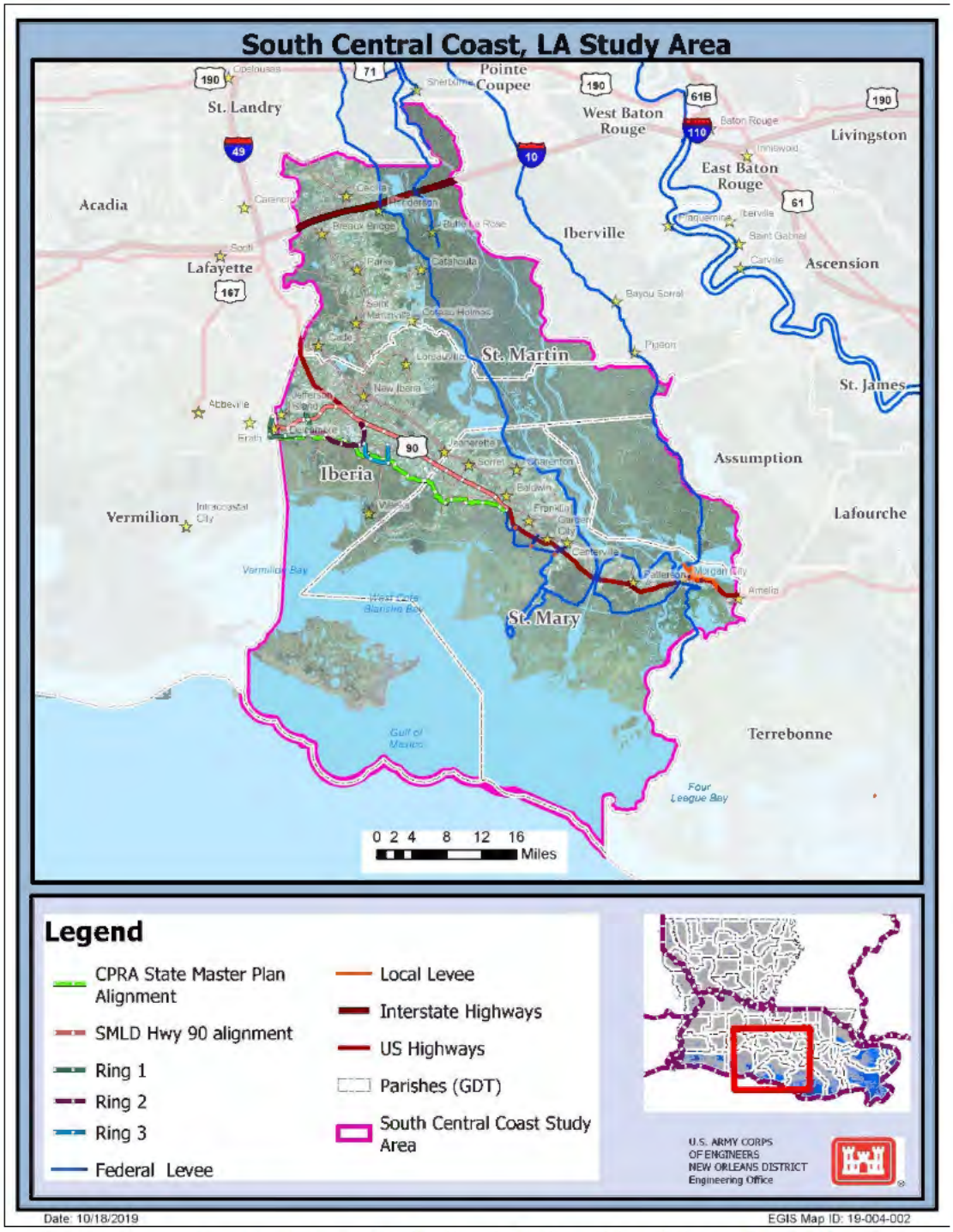


Figure ES-1. South Central Coast Louisiana Study Area

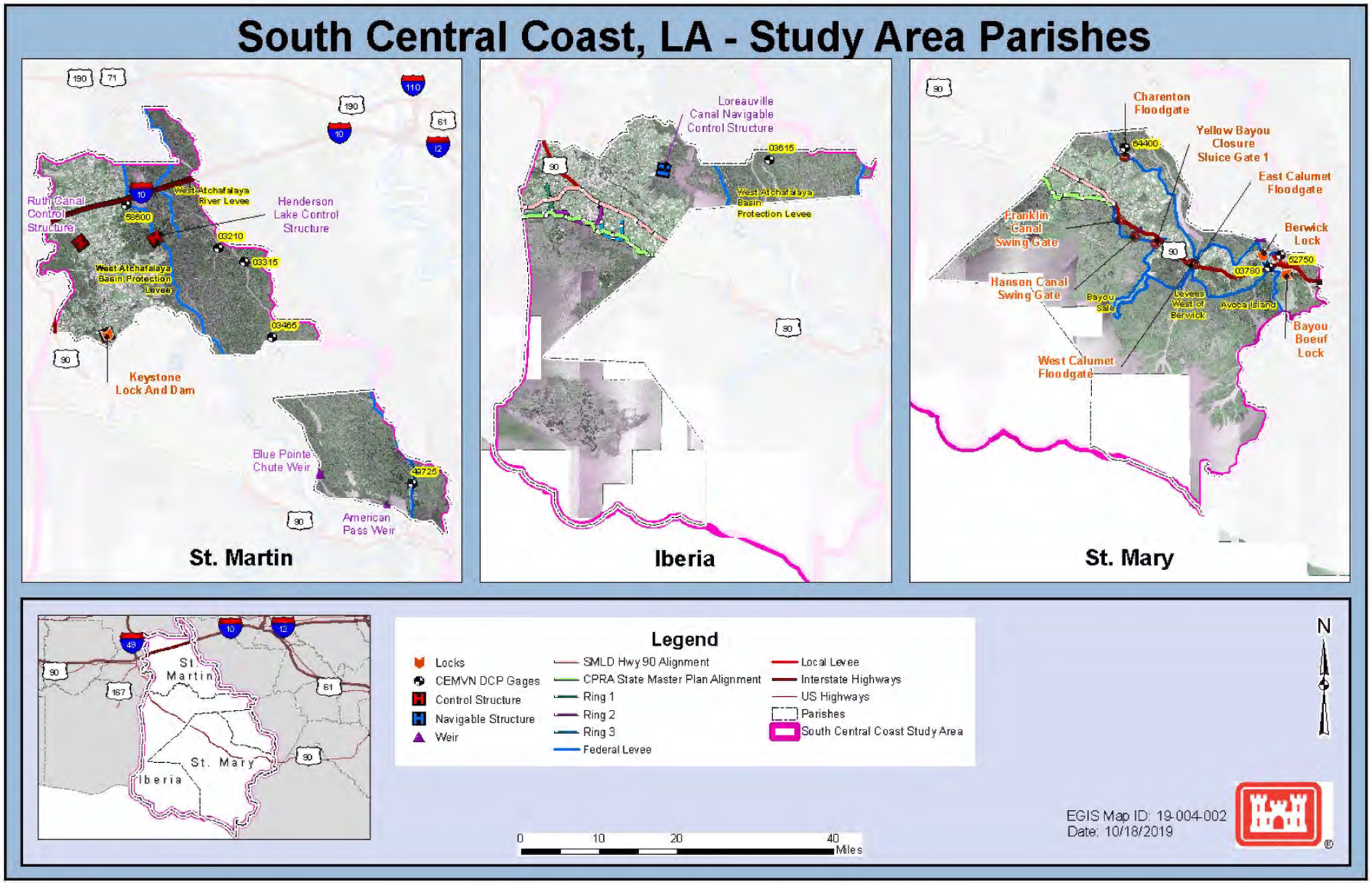


Figure ES-2. South Central Coast Louisiana - Study Area Parishes

System-wide problems and opportunities were used to identify and define site-specific problems and opportunities. Problems in the SCCL study area include:

- Hurricanes and tropical storm events pose a significant risk to the communities, ecosystems, and industries of the Louisiana gulf coast.
- Numerous storm events, including Hurricanes Laura (2020), Barry (2019), Lee (2011), Ike (2008), Gustav (2008), Rita (2005), Lili (2002), Bertha (2002), Allison (2001), and Andrew (1992), affected the entire study area and resulted in economic damages, loss of property, loss of life, and repeated mandatory evacuation costs.
- Hurricane storm surge can cause significant, permanent damage to wetlands. Development, including oil and gas and navigation channels, has also adversely affected wetlands. Historically, from 1932 to 2010, the area experienced a net loss of approximately 22,500 acres of wetlands, which reduced the natural resiliency of this area. Highly erodible soils in the region also contribute to land loss during these events.
- The low elevations and tidal connections to the Atchafalaya River Basin place several of the population centers at risk of flooding from storm surge and hurricanes.
- Exacerbating the flooding is the phenomenon of relative sea level rise (RSLR), which is the combination of water level rise and land subsidence. The highest rates of RSLR of all North American coastal communities are found in the SCCL study area (Intergovernmental Panel on Climate Change (IPCC), 2007).
- Waves can result in damages to raised infrastructure, residential, public, and commercial structures.

Note: The Atchafalaya Floodway, a major drainage system along the eastern side of the study area, is bordered by large Federal levees. The Atchafalaya Floodway largely mitigates for economic damages from riverine flooding, although it does not eliminate flood risk and damages completely. A majority of the area affected within the 50-year flood extent is located on land that the government owns in fee or has existing easements over. Despite the Atchafalaya Floodway, economic damages are not 100 percent mitigated, but a measure to further reduce risk from riverine flooding would result in relatively low benefits over the 50-year period of analysis due to the low return flood frequency. Therefore, solutions associated with residual riverine damages were not pursued. Details regarding riverine flooding frequencies within the Atchafalaya Floodway are discussed in Section 2.9.1 of this report and in Appendix C: Hydraulics, Hydrology, and Climate Preparedness and Resiliency.

Opportunities to reduce damages associated with problems in the SCCL study area include:

- Reduce the risk to life safety, land, and property.
- Reduce risk to key nationally significant commodities and critical infrastructure.

- Leverage local, state, and Federal entities efforts to manage flood risk.
- Reduce flooding in low areas of the evacuation corridor and ensure highway (Hwy) 90 is a reliable evacuation route.

The USACE team developed three planning objectives to apply to the entire study area for the 50-year period of analysis (2025-2075):

Objective 1. Reduce risk to life safety from hurricanes and storm surge within St. Martin, St. Mary, and Iberia Parishes.

Objective 2. Reduce economic loss/damages, as a result of hurricanes and storm surge, to structures (i.e., residential, commercial, agricultural, and industrial) within the study area.

Objective 3. Reduce risk to and enhance reliability of the primary evacuation route for study area residents and the greater city of New Orleans area (Hwy 90).

The planning team identified the following planning constraints:

- Commercial navigation - The navigation channels in the study area and the GIWW carry significant navigation traffic. Therefore, features that might result in shipping delays or undermine the purposes of authorized navigation projects would likely result in negative NED impacts.
- Appropriation authority - The study appropriation does not allow for development of measures or alternatives outside of coastal storm risk management (CSRM) or flood risk management (FRM) and consideration of ecosystem restoration is not authorized.
- Mississippi River and Tributaries (MR&T) deficiencies - MR&T authorized design heights are assumed in the estimation of costs and benefits.
- Existing projects - Avoidance of impacts to existing Federal projects within the study area.
- Hurricane and Storm Damage Risk Reduction System (HSDRRS) - USACE guidance requires all levees designed to reduce risk of flooding from hurricane storm surge to meet the more stringent HSDRRS design standards.

IMPORTANT TERM

NATIONAL ECONOMIC DEVELOPMENT BENEFITS

The Federal objective of water and related land resources planning is to contribute to National Economic Development (NED) consistent with protecting the Nation's environment resources. NED benefits are calculated by subtracting the total NED average annual costs from the NED average annual benefits.

When project benefits divided by costs are <1.0, a water resources project is not economically justified

National Economic Development (NED) Planning

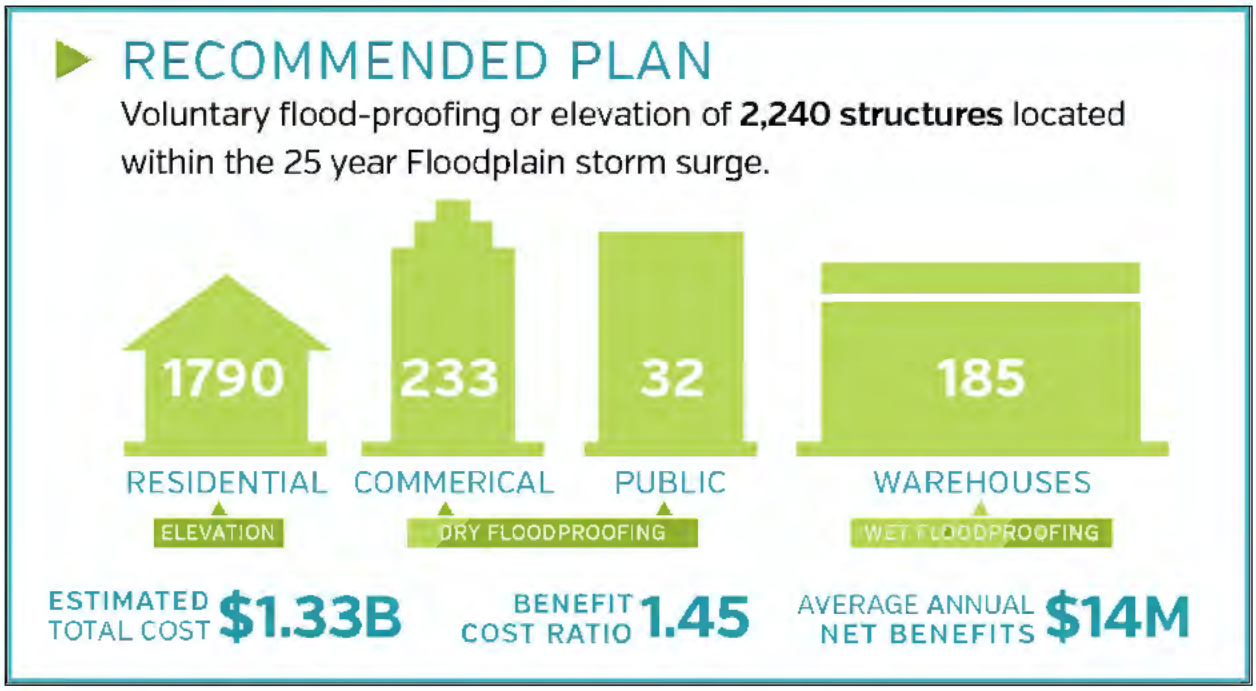
CSRM measures were developed and screened using preliminary costs and benefits to identify a focused array of NED alternatives. As a result of the economic assessment,

only two nonstructural alternatives were found to be economically justified. In addition to the No Action Alternative, the focused array contained these two stand-alone nonstructural alternatives.

At the tentatively selected plan (TSP) milestone, nonstructural alternatives with economic justification included: **Alternative 1:** Floodproofing and elevations of structures within the 25 year storm surge floodplain and **Alternative 2:** Floodproofing and elevations of structures within the 50-year storm surge floodplain.

The evaluation of the measures and alternatives determined that nonstructural measures, including structure elevations and floodproofing, are the most cost-effective solution to reduce coastal storm risk within the study area. The final alternatives evaluation resulted in identification of Alternative 1: Floodproofing and elevations of structures within the 25 year storm surge floodplain as the TSP.

Further refinement of Alternative 1 occurred during feasibility level of design phase to optimize benefits and use best available hydraulic and structural data and hydraulic modeling. Following the feasibility level of design phase, the alternative that reasonable maximized net benefits and that is implementable under existing policy and authoriziations was identified as the RP. The RP consists of elevating residential structures, dry floodproofing or wet floodproofing of commercial and public structures within the 0.04 annual exceedance probability (AEP) (25 year storm surge floodplain)as shown in Figure ES-3.



Note- Estimated Total Cost reflected is Fully Funded Cost FY22 Interest Rate

Figure ES-3: Recommended Plan

A brief summary of the components of the RP includes:

- Elevation of eligible structures. Elevation of 1,790 structures to an elevation no greater than 13 feet above ground surface elevation. Elevation of the entire structure or the habitable area of a structure would allow floodwaters to flow and recede underneath.
- Dry floodproofing of eligible structures. Dry floodproofing 265 structures to reduce flood risk. Dry floodproofing would ensure that floodwaters cannot get inside by making walls, doors, windows, and other openings impermeable to water penetration up to three feet above grade.
- Wet floodproofing of warehouses or other eligible industrial structures. Floodproofing 185 structures to wet floodproofed the structure envelope up to 12 feet. -Wet floodproofing would allow floodwaters to enter and exit structures areas through vents, protecting the structural stability of a warehouse. Elevation of utility connections to the building and flood resistant materials to the structure envelope would be implemented.
- Floodplain Management Plans. The non-Federal sponsor (NFS) is required to prepare a floodplain management plan to maintain the integrity of the project. The NFS shall work with the governing bodies within the three parishes to ensure consistency with local development plans and regulations.

Additional recommendations that may be implemented by others that will further reduce the residual risks associated with coastal storm damages include:

- Content protection measures of wet floodproofed buildings - While wet floodproofing reduces structural damages, it does not reduce the risk and associated benefits to contents. The NFS, or individual owners, are encouraged to consider implementing content protection measures.
- Adoption of more stringent local floodplain regulations - Although communities within the study area cannot change the minimum National Flood Insurance Program (NFIP) standards, the NFS should work with the local governments to adopt local standards that achieve higher levels of flood risk reduction. Examples of potential actions may include replacing elevation requirements based on the 0.01 AEP to the 0.2 AEP level of risk reduction; implementing a zero rise floodway; and adopting cumulative damages as the trigger for substantial damage determination.
- Adoption of more restrictive parish and municipal building codes, land use and zoning regulations, and other developmental controls - Local governments within the floodplain should be encouraged to adopt, implement, and enforce stricter building and housing code requirements, land use and zoning regulations, and other developmental controls aimed at reducing flood risk and flood damage.

The 100 percent voluntary RP would provide reduced coastal storm risk for structures in the study area with a first floor elevation (FFE) at or below the 25 year stage based on predicted year 2025 hydrologic conditions. Coastal storm risk for a total of 2,240

structures would be reduced, including: 1,790 residential, 233 commercial, 32 public, and 185 warehouse structures.

Residential structures elevated 13 feet above ground surface elevation would have the highest level of risk reduction in the study area, especially those located more inland on higher ground surface. The structures with the lowest level of risk reduction are those that would be dry floodproofed, where the mitigation has a ceiling of 3 feet and therefore only mitigates the highest frequency events. Within the study area, damages would be reduced by the measures included in the RP by 17 percent. Within the project area (0.04 AEP storm surge floodplain), damages would be reduced by 28 percent by the measures included in the RP.Of the structures being elevated, 50 percent would have a risk reduction that exceeds the existing condition (2025) 0.002 AEP.

Figure ES-4 identifies locations of structures and their preliminary determined method of elevating or floodproofing. The estimated fully-funded total project cost for the RP is $1,334,413,000. The estimated project first cost at a FY 2022 price level is $914,769,000. Table ES-1 provides a summary of the estimated RP average annual cost and benefits (damages reduced) over the 50-year period of analysis. Figure ES-5 illustrates locations and existing condition-modeled flood depths for the identified structures in year 2025.

IMPORTANT TERM

ANNUAL EXCEEDANCE PROBABILITY (AEP)

The percent chance of a particular storm event being exceeded in any one year.

A 0.01 AEP has 1% chance or 1 in 100 chance occurring in any one year.

That ***same*** 0.01 AEP storm event has a **9.6% chance of occurring in any 10 year period.**

0.01 AEP can be considered equivalent to the 100 year storm event.

Figure ES-4. Geographic Distribution of Structures in the 25 Year RP Nonstructural Project and Floodproofing or Elevation Method

Figure ES-5. Flood depth for 0.04 AEP for eligible structures in the 25 year RP

Table ES-1. RP Cost and Benefit Summary

Alternative 1- Elevation and Floodproofing of Structures within the 25yr Floodplain	
Cultural Resource Mitigation Cost	$14,723,000
Interest During Construction	$2,542,000
Total Project Cost (Fully Funded)	$1,334,413,000
Project First Cost	$914,769,000
Average Annual Cost	$31,048,000
Average Annual Benefits	$ 45,130,000
Net Benefits	$ 14,082,000
Benefit-Cost Ratio	1.45

*Costs are rounded to the nearest thousand.
*Cost and benefits in FY22 values.

Scoping and Early Agency Coordination: USACE held five study kickoff meetings at the start of the SCCL planning process. These included one resource agency meeting, two community and levee district leaders' meetings, and two public meetings (see Appendix J: Public Involvement and Scoping).

The USACE issued a notice of intent (NOI) to prepare an environmental impact statement for the SCCL project in the Federal Register (Vol. 84, No. 63 on April 2, 2019). The NOI included a 45-day public comment period, ending on May 17, 2019. On April 10, 2019, the USACE sent cooperating agency letters to the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) (National Marine Fisheries Service (NMFS)). The USACE sent a cooperating letter to the Federal Emergency Management Agency (FEMA) on May 22, 2019. The USACE held two public scoping meetings on May 14 and 15, 2019. Appendix J: Public Involvement and Scoping, summarizes these meetings. Input received from public meetings assisted the project team in refinement of project problems and opportunities, goals, objectives, and potential measures.

Draft Integrated Feasibility Report and Environmental Impact Statement (IFR/EIS) Review.The USACE conducted concurrent review of the draft IFR/EIS, including public, technical, legal, and policy reviews, as well as a type I independent external peer review (IEPR). Comments were considered during the review period, prior to providing feedback to a USACE Headquarters Senior Leaders Panel. That panel considered the evaluation of the significant public, technical, legal, policy, and IEPR comments on the TSP and other alternatives to determine the endorsement of a RP and proposed way forward.

From November 22, 2019, to January 6, 2020, the draft report was published for a 45-day public comment period.During that time, USACE held two public meetings to solicit

comments. A total of 42 comments were received during the comment period. The comments were generally in favor of structural measures and were concerned with costly Federal levee standards versus standard levee construction costs. Some comments focused on if nonstructural measures would be voluntary or nonvoluntary. Other comments focused on ways to improve the shrimping industry and baseline environmental information. There were no controversial issus raised during the draft public review.

The Recommended Plan was Alternative 1 which consisted of implementation of non-structural floodproofing measures on a total of 3,463 structures including residential buildings, commercial buildings, public buildings, and warehouses.

Final IFR/EIS Review: The USACE conducted a 30-day State and agency review on the final IFR/EIS from July 21, 2021 – August 20, 2021. No substantive comments were received. The USEPA requested a copy of the signed ROD once it is signed.

The SCCL Final IFR/EIS, dated June 2021, was available to the public from September 3, 2021 - October 4, 2021. The RP, Alternative 1, was revised from the draft report to consist of implementation of nonstructural floodproofing measures on a total of 2,240 structures, including residential buildings, commercial buildings, public buildings, and warehouses. Alternative 1 had a reduction in number of residential, commercial, and public buildings receiving nonstructural floodproofing – residential buildings (~30 percent reduction), commercial buildings (~60 percent reduction) and public buildings (~55 percent reduction) deemed preliminarily eligible to receive. The number of potential warehouses to be floodproofed increased by 10 percent and the method of floodproofing changed from dry floodproofing (seal structure to a specific height, elevate electrical, ventilating, and air contioning (HVAC), to wet floodproofing. Warehouse wet floodproofing measures in Alternative 1 include installing vents in buildings, elevating electrical, HVAC, constructing elevated modular offices and installing hoists and shelves to elevate and protect building contents in advance of storms.

During the Final EIS's 30-day review period, the USEPA provided a comment stating it had no objection to this proposed action.

Draft Supplemental IFR/EIS Reivew: The SCCL Supplemental Draft IFR/EIS dated April 2022 was available for public review from April 1 - May 16, 2022. The RP was a further refinement of Alternative 1 evaluated in the Final IFR/EIS, above. There was no change in the number and type of structures deemed preliminarily eligible to received nonstructural floodproofing. The following measures were no longer recommended for implementation at the warehouses: constructing elevated modular offices and installing hoists and shelves. The RP includedthe following warehouse wet floodproofing measures: installing vents in buildings and elevating electrical and HVAC. The USEPA provided the only comment during the 45-day comment period. In a letter dated May 10, 2022, the USEPA stated it has no comments on the proposed action.

No known controversial issues with the RP were identified during previous-agency and public involvement.

The most likely scenario for voluntary participation is a rate of 65 percent for the RP. While the RP herein provides a significant suite of measures to reduce coastal storm risk in South Central Louisiana, the plan will not solve all of St. Mary, Iberia, and St. Martin Parishes' flooding problems and associated damages. Under the RP, there remains residual risk from flooding because there are locations within the study area that are outside of the 25-year floodplain that will continue to see impacts to roadways, utilities, and the natural environment as a result of coastal flooding.

The USACE team will continue to engage interested parties, the NFS, State and Federal agencies, and Tribes throughout the remaining project planning and implementation phases. The USACE team will also continue its close project relationship with the State Historic Preservation Office (SHPO) and Tribes though the execution of a programmatic agreement (PA). This PA allows USACE to coordinate Section 106 reviews with its evaluation of the proposed action's potential for significant impacts to the human and natural environment required by the National Environmental Policy Act (NEPA), as amended (42 U.S.C. § 4321 et seq.). The PA governs USACE's subsequent National Historic Preservation Act (NHPA) compliance efforts and any additional conditions or requirements will be documented at that time.

After the final feasibility report is submitted to USACE headquarters (June 2022), a Chief's Report will be developed for review and approval by the Chief of Engineers, with such modifications as the Chief Engineer deems necessary. Once the Chief of Engineers signs the report, the Chief of Staff signs the notification letters forwarding the report to the chairpersons of the Senate Committee on Environmental and Public Works and the House of Representatives Committee on Transportation and Infrastructure. The signed Chief's Report is also provided to the Office of the Assistant Secretary of the Army for Civil Works for review by the Administration.

This USACE submitted the RP for authorization as a Federal project, with such modifications thereof, at the discretion of the Commander, Headquarters, USACE. The NFS, Coastal Protection and Restoration Authority Board (CPRAB), supports the RP, but final approval and letters of support are subsequent to concurrent review of the final report.

The USACE recognizes the project authority and formulation methodology is limited in what it can provide. It is recommended additional actions by the sponsor and other entities be considered in a holistic approach to further mitigate coastal storm damages and increase overall resiliency.

Section 1
Introduction

This final supplemental IFR and EIS documents the plan formulation process, evaluation and comparison of alternatives, and identification of a RP for the SCCL study area. Impacts to relevant resources were analyzed for the final array of alternatives and described for the RP.

1.1 STUDY AREA

The SCCL study area encompasses 2,966 square miles of varying terrain in St. Martin, St. Mary, and Iberia Parishes (Figure 1-1). The majority of the study area borders Vermilion and West Cote Blanche Bays, which are located in the Gulf of Mexico. The study area has major thoroughfares and intersections, connecting a large portion of the southern part of Louisiana.

In addition to the adverse impacts resulting from repeated storm events, such as Hurricanes Rita, Ike, Gustav, and Barry, this area is vulnerable to coastal land loss and degradation further reducing natural resiliency, which increases risk to communities, habitat, and infrastructure.

Critical infrastructure, including, but not limited to, wastewater treatment plants, strategic petroleum reserves, regional and local hospitals, fire stations, electric power generation plants and substations, and public schools, are currently at risk from storm surge.

Key existing infrastructure at risk from storm surge flooding also includes, but is not limited to:

- Evacuation routes for the residents within the study area and the greater New Orleans area (Hwy 90)
- Port of Morgan City
- Port of West St. Mary
- Port of Iberia
- GIWW and Bayou Teche
- Wax Lake Outlet and Pumping Station
- Keystone Lock and Dam
- Berwick Lock and Bayou Boeuf Lock
- Harry P. Williams Memorial Airport major transportation corridors

The area is at risk of damages from flooding from tropical storms and hurricanes, which have repeatedly impacted this part of the Louisiana coast. Approximately 177,000 people reside within the study area. The GIWW transects the study area, with most population centers occurring north of the GIWW. The largest municipalities include Breaux Bridge and St. Martinville in St. Martin Parish; New Iberia, Jeanerette, Delcambre, and Loreauville in Iberia Parish; and Morgan City, Franklin, Patterson,

Baldwin, and Berwick in St. Mary Parish. Tribal Lands that the federally-recognized Chitimacha Tribe of Louisiana exercises sovereignty over encompass the majority of the community of Charenton in St. Mary Parish.

Commercial activities in the study area include the Port of Morgan City, Port of West St. Mary, and Port of Iberia, GIWW and Bayou Teche, Keystone Lock and Dam, Berwick Lock, and Bayou Boeuf (St. Martin, Iberia, St Mary Parishes, Louisiana) Lock, the Wax Lake Outlet and Pumping Station, and the Harry P. Williams Memorial Airport. Highway 90 is a major transportation corridor and key evacuation route within the study area.

(USACE and the CPRAB propose to implement CSRM measures in the SCCL area. The USACE will identify a variety of CSRM strategies that improve the region's flood resiliency, and reduce flood fighting and flood clean-up costs, while meeting the congressionally authorized purposes. The USACE's flood risk reduction measures would also strive to promote the culture and livelihood of the area, while maintaining public safety over the life of the project. While it is impossible to eliminate all coastal storm risk, the goal of this study is to evaluate structural, nonstructural, and nature-based measures to meet the project's objectives.

Figure 1-2 shows key existing civil works infrastructure in the study area.

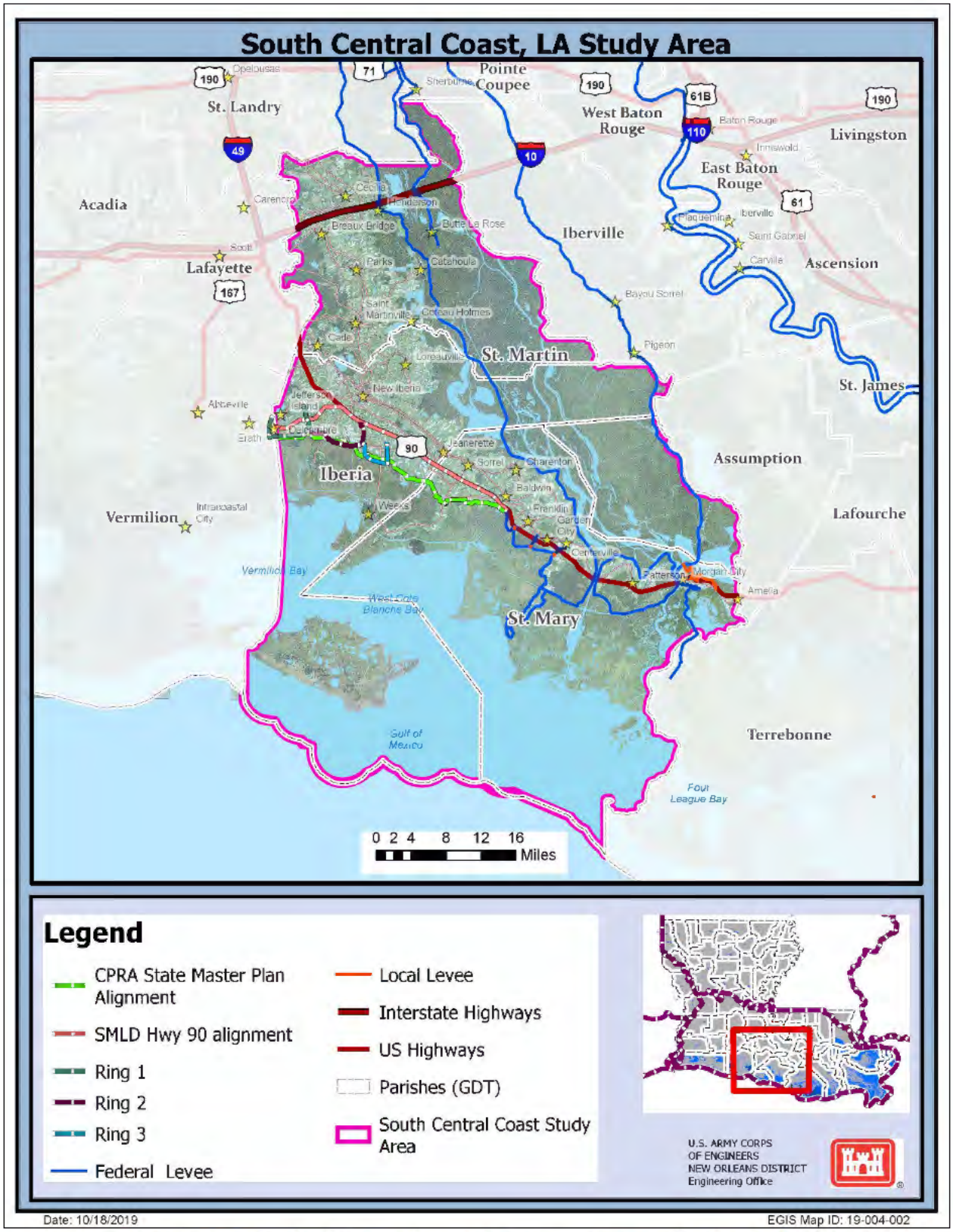


Figure 1-1. South Central Coast, Louisiana Feasibility Study Area

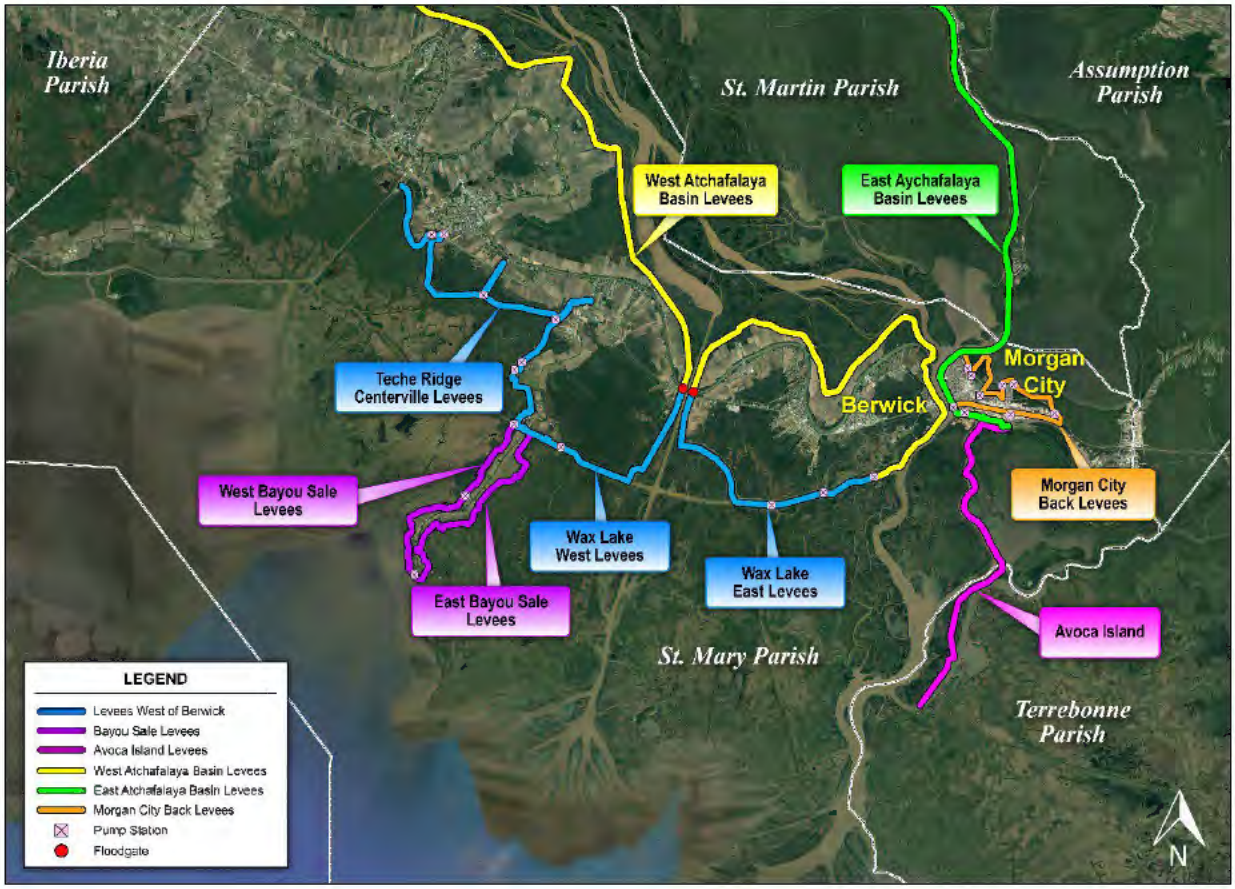


Figure 1-2. Key Existing Civil Works Infrastructure

1.2 STUDY SCOPE

The study scope was authorized to address comprehensive investigations of both CSRM and FRM problems and solutions. The USACE considered past, current, and future management and resilience projects underway by the USACE and other Federal, state, and local agencies within the study area. The USACE performed three overarching efforts:

- Assess the study area's problems, opportunities, and future without project (FWOP) conditions for a 50-year period of analysis from 2025-2075,
- Assess the feasibility of implementing system-wide coastal storm damage reduction solutions, and,
- If system wide solutions are not feasible, assess the feasibility of implementing site-specific solutions, including structural, nonstructural, and natural and nature-based features, or possibly a combination thereof.

Features recommended in final decision documents are at a 35 percent design level, using existing data (such as topography and subsurface conditions) as much as

possible. During preconstruction engineering and design (PED) phase, USACE would use detailed data and final design calculations to complete a 100 percent design.

USACE prepared this feasibility report in accordance with USACE SMART Planning procedures, as authorized in accordance with Section 1001 of the Water Resources and Reform Development Act of 2014, (WRRDA 2014), as amended by Section 1330(b) of the Water Resources Development Act of 2018, (WRDA 2018) and implementation guidance dated March 25, 2019, and in accordance with the NEPA of 1969 (40 Code of Federal Regulation (CFR) 1500-1508 and the USACE NEPA implementing Engineer Regulation (ER) 200-2-2 (33 CFR 230). This document serves as an IFR/EIS. The USACE is the lead Federal agency under NEPA. The CPRAB is the NFS, subject to continued participation.

This report documents the USACE's planning process for this feasibility study and the evaluation and comparison of a final array of alternatives, including the No Action Alternative. The USACE prepared this report to comply with NEPA and applicable Federal, state, and local environmental laws and regulations. The outcome of the planning process is the identification of the NED plan and designation of the RP.

1.3 PURPOSE AND NEED

Through separate study and funding authorizations, Congress authorized the investigation of alternatives to provide flood risk reduction to St. Martin, St. Mary, and Iberia Parishes in South Central Louisiana (see Section 1.9). The Federal objective of water and related land resources project planning is to contribute to NED consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders (EO), and other Federal planning requirements.

St. Mary, St. Martin, and Iberia Parishes have high levels of risk and vulnerability to coastal storms, exacerbated by a combination of sea level rise and climate change over the study periods. The study area's low elevation topography, proximity to the Gulf of Mexico, subsiding lands, rising seas, and wave action are contributing factors causing coastal flooding, shoreline erosion, and loss of wetlands further reducing natural resiliency. The people, economy, environment, and cultural heritage of coastal areas in South Central Louisiana are at risk from reoccurring damages caused by hurricane storm surge flooding.

The Atchafalaya Floodway, a major drainage system along the eastern side of the study area, is bordered by large Federal levees. The Atchafalaya Floodway largely mitigates for economic damages from riverine flooding, although it does not eliminate flood risk. A majority of the area affected within the 50-year flood extent is located on land that the government owns in fee or has existing easements over. Despite the Atchafalaya Floodway, economic damages are not 100 percent mitigated, but a solution designed to reduce risk from riverine flooding would result in relatively low benefits over the 50-year period of analysis due to the low return flood frequency. Therefore, solutions associated with residual riverine damages were not pursued. Details regarding riverine flooding frequencies within the Atchafalaya Floodway are discussed in Section 2.9.1 of this

report and in Appendix C: Hydraulics, Hydrology, and Climate Preparedness and Resiliency.

The study area had 57 Federal disaster declarations between 1964 and 2020 as a result of hurricanes and tropical storms. The study area experienced repeated storm events, including Hurricanes Laura (2020), Barry (2019), Isaac (2012), Ike (2008), Gustav (2008), Rita (2005), Katrina (2005), Ivan (2004), Lili (2002), Isidore (2002), Allison (2001), George (1998) and Andrew (1992). The impacts resulted in loss of life, economic damages, repeated mandatory evacuation costs, and continued degradation of natural defense provided by marsh habitat. Due to projected RSLR, land subsidence, and climate change, the USACE forecasts the study area conditions will worsen over the 50-year period of analysis without additional storm mitigative measures.

The SCCL feasibility study's purpose is to investigate potential structural and nonstructural solutions (measures) to address coastal storm risk.

Project implementation would reduce coastal storm risk in the area by increasing sustainability and resiliency to storms for the affected communities.

1.4 FEDERAL INTEREST

The SCCL study area is extremely vulnerable to coastal storm events. CSRM is an identified primary mission area of USACE. The SCCL study area is home to these nationally significant industries:

- Carbon Black: Cabot Corporation, Columbian Chemicals, and Degussa Engineered Carbon black manufacturing plants, are among the largest carbon black producers in the U.S.
- Ship building and fabricating, the oil and gas services, and extraction industries vital to the U.S. economy
- Petroleum: The Strategic Petroleum Reserve maintains storage facilities immediately north and west of the study area with transfer and processing infrastructure traversing the area.
- Sugar Cane: The study area is the heart of the sugar cane production area for the state. Out of the 11 raw sugar-manufacturing mills in Louisiana, five are located in the study area including Sterling Sugars, St. Mary Co-op, Enterprise Factory, Cajun Sugar Co-op, and LA Sugar Cane, Inc.
- Tourism: The area, designated as the Atchafalaya National Heritage Area, depends on unique Creole and Cajun tourism opportunities.
- Recreation: The study area is comprised of ecosystems having national significance as demonstrated by the presence of Bayou Teche National Wildlife Refuge (NWR) and the State of Louisiana Marsh Island Wildlife Refuge and the Attakapas and Atchafalaya Delta Wildlife Management Areas (WMA).

A Federal interest exists in the reduction of life safety risk to approximately 177,000 residents within the study area. In addition, coastal storms can impact Highway 90,

which transects the study area, and is a key evacuation route for area residents and the 393,292 residents of the City of New Orleans (CPRA Master Plan, 2017).

1.5 PROBLEMS AND OPPORTUNITIES

1.5.1 Problems

The study area has approximately 177,000 people at risk from hurricane, storm surge flooding, and wave action. Population centers within the study area are largely rural and spread out. The largest municipalities include Breaux Bridge and St. Martinville in St. Martin Parish; New Iberia, Jeanerette, Delcambre, and Loreauville in Iberia Parish; and Morgan City, Franklin, Patterson, Baldwin, and Berwick in St. Mary Parish. Population growth in the future is expected to be minimal. Deaths directly attributed to storm surge and hurricanes are currently low within the study area (based on historic information). However, this risk is expected to increase with the associated increased storm frequencies and intensities described in Section 2.9.1 of this report. In parishes adjacent but not within the study area, deaths associated with intense storms such as Hurricane Katrina, resulting in an estimated 1,800 deaths, have illustrated this trend (https://www.fema.gov/disasters/historic/hurricane-katrina).

Flooding from tidal surge and waves associated with tropical storms and hurricanes are frequently damaging structures, critical infrastructure, communities, ecosystems, and industries of the Louisiana gulf coast. Storm events, including Hurricanes Laura (2020), Barry (2019), Lee (2011) Ike (2008), Gustav (2008), Rita (2005), Lili (2002), Bertha (2002), Allison (2001), and Andrew (1992), affected the entire study area and resulted in economic damages, loss of property, loss of life, and repeated mandatory evacuation costs. This area will continue to suffer from natural disasters without some form of coastal storm risk solution. Historically, from 1932 to 2010, the area experienced a net loss of approximately 22,500 acres of wetlands, reducing the natural flood resiliency of this area. The study area is relatively flat with nearly all areas at an elevation below 10 feet (North American Vertical Datum of 1988). The low elevations and tidal connections to the Atchafalaya River Basin place several of the population centers at risk of flooding from storm surge and hurricanes. Continued wetlands losses will result in increased damages to the human environment. Wave heights are forecasted to add four to five feet to still water conditions (see Section 2.9 and Appendix C for details).

RSLR, which is the combination of water level rise and land subsidence, exacerbates the future flooding and economic damages. Soils within, south central Louisiana are generally characterized as weak and at risk for general subsidence and the global incidence of sea level rise. Sea level rise increases risk by raising the initial water elevation (stillwater) that hurricanes interact with, thereby increasing storm surge and wave elevations. Figure 1-3 depicts the combined effects of subsidence and sea

level rise. The study area has the highest rates of RSLR in North American coastal communities (IPCC, 2007) (see Section 2.9 for details).

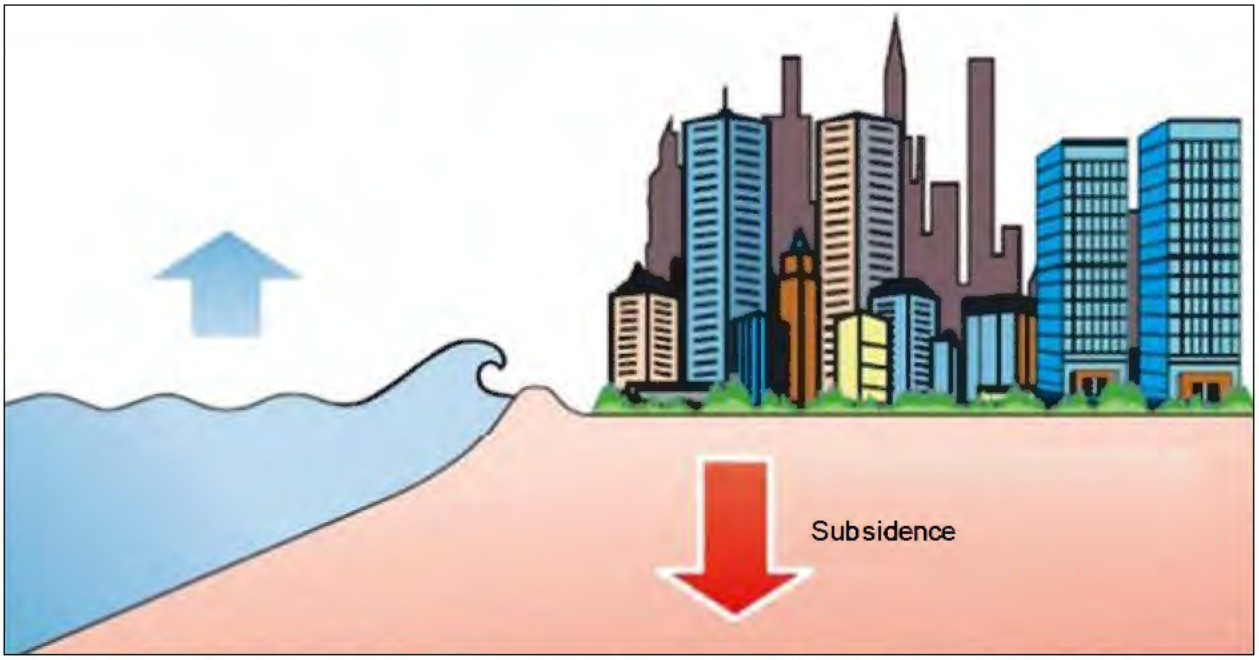


Figure 1-3. Graphical Depiction of Subsidence and Sea Level Rise Effects
(Adapted from Erkens et al., 2015)

Subsidence, consolidation, potential sea level rise scenarios, and estimated wave action rates for existing conditions and forecasted future conditions are included in Section 2 Inventory and Forecasted Conditions. Estimations were taken into account when determining effectiveness and feasibility of potential measures.

Planning for anticipated subsidence, both short-term and long-term, is included in the feasibility evaluation. Specific measure considerations are included in Section 3.2 Management Measures.

The combined effect of subsidence and sea level rise will continue to increase risk within the south central study area, increasing the risk of levees being overtopped. This, in turn, increases the following:

- risk to life safety,
- risk of damage to property & infrastructure,
- regional economic impacts,
- risk to cultural heritage, population, other social effects (OSE),
- risk of environmental damages and human health safety impacts from industrial flooding.

1.5.2 Opportunities

Because USACE's top priority is public safety, this study identified what areas within the study area are at the highest risk, drivers of the risk (storm surge or riverine), and potential mitigative features. If the USACE and CPRAB implements structural or nonstructural mitigative features, those features could provide the following opportunities:

- reduce flood damages and life safety risk to approximately 177,000 residents and associated community structures
- reduce flood risk and damage to key nationally significant commodities and critical infrastructure located within the study area
- leverage local, state, and Federal efforts and funding to manage existing and forecasted flood risk and,
- reduce flooding in low areas of the evacuation corridor and ensure Hwy-90 is a reliable evacuation route.

Though this study was not authorized to address damages from rainfall events, an assumption was made that measures that reduce coastal and riverine damages would also reduce risk for rainfall event damages for events between 25 and 200 years.

1.6 PLANNING GOAL/OBJECTIVES

The goal of the study is to identify ways to increase sustainability and resiliency of communities to coastal storm events.

PROJECT GOAL

Identify ways to increase sustainability and resiliency of communities to coastal storm events.

Within that overarching goal, the **three main objectives of the study include:**

1. Reduce risk to life safety from hurricanes and storm surge within St. Martin, St. Mary, and Iberia Parishes.
2. Reduce economic loss/damages, as a result of hurricanes and storm surge, to structures (i.e., residential, commercial, agricultural, and industrial) within the study area.
3. Reduce risk to and enhance reliability of the primary evacuation route for study area residents and the greater New Orleans area (Hwy 90).

1.7 PLANNING CONSTRAINTS AND CONSIDERATIONS

A planning constraint limits the extent of the plan formulation process.

Constraints considered for the SCCL study are:

- *Commercial navigation.* The navigation channels in the study area and the GIWW carry significant navigation traffic. Therefore, features that might result

in shipping delays or undermine the purposes of authorized navigation projects would likely result in negative NED impacts.

- *Levee design standard.* USACE guidance requires all levees designed to reduce risk of flooding from hurricane storm surge to meet the more stringent HSDRRS design standards.
- *Appropriation authority*. The study appropriation does not allow for development of measures or alternatives outside of CSRM or FRM and consideration of ecosystem restoration is not authorized.
- *Existing projects*. Avoidance of impacts to existing Federal projects within the study area (GIWW, MR&T, etc.).
- *MR&T deficiencies*. MR&T authorized design heights are assumed in the estimation of costs and benefits.
- *Negative secondary effects*. Avoidance of measures that would induce or exacerbate flooding or negatively affect life risk in the study area or vicinity as a result of the implementation of proposed measure(s).

As applicable, endangered species and critical habitat study-specific constraints or time of year restrictions for threatened and endangered (T&E) species will be included in measure feasibility determinations.

Planning considerations for the study:

- Cost-prohibitions of increasing the height of hard structures (floodwalls, closure structures) thus limiting the maximum effective risk reduction.
- Avoidance of 404(c) areas, if possible. The USACE will conduct early coordination with EPA as needed.
- Limited open land adjacent to existing levee systems. Increases in elevation to existing levees and/ or new levees may be dependent upon availability of adjacent lands.
- Wave heights within the study area are estimated to add four to five feet to still water conditions.
- Cost and availability of wetland mitigation credits within designated watersheds.
- Potential transfer of flood risk to areas outside the study area.
- Minimization of impacts to parish and community tax base.
- The maintenance of cultural and socio-economic cohesiveness across different neighborhoods and avoidance of isolating neighborhoods.
- Ways to maximize funding for CSRM studies and projects by leveraging and combining Federal, state, and local resources.
- Avoidance, minimization, and/or mitigation of:
    - Adverse effects to sites listed or eligible for listing on the National Register of Historic Places (NRHP), including: buildings, structures, objects, archaeological sites, and/or properties of religious or cultural significance to Tribes;

- Impacts to environmental resources, particularly wetlands, within the study area;
- Socio-economic and environmental justice impacts in the project area and neighboring cities; and,
- Avoidance and minimization of siting of project features on lands known to have hazardous, toxic, and radioactive waste (HTRW) concerns.

1.8 STUDY STAKEHOLDER AND COORDINATING AGENCIES

The CPRAB executed the feasibility cost-share agreement for this study on October 9, 2018. The State of Louisiana established the CPRAB with authority to articulate a clear statement of priorities and to focus development and implementation efforts to achieve comprehensive coastal protection for Louisiana. The CPRAB's mandate is to develop, implement, and enforce a comprehensive coastal protection and restoration Master Plan (2017). Working with Federal, state, and local political subdivisions, including levee districts, the CPRAB is working to establish a safe and sustainable coast to protect communities, the nation's critical energy infrastructure and Louisiana's natural resources into the future.

The Federal government and the CPRAB may cost share all or a portion of the cost of implementation.The CPRAB is responsible for provision of lands, easements and rights-of-way. The CPRAB remains responsible for all costs of operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of project features following construction completion.

The USACE and the CPRAB have a close working relationship. The CPRAB has been an active participant in every public meeting and ongoing team meetings.

The USACE invited the USFWS, FEMA, and the NOAA, NMFS to be cooperating agencies in accordance with NEPA (40 C.F.R. § 1501.6 and § 1508.5) and One Federal Decision, EO 13807, titled, Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects, 15 August 2017. By letter dated May 17, 2019, NOAA accepted the invitation to be a cooperating agency. However, in a letter dated October 2, 2019, NOAA elected to withdraw as a cooperating agency based on the USACE's "No Effect" determination on NOAA/NMFS trust resources. The FEMA and USFWS accepted their role as cooperating agencies by not declining the USACE's request (Appendix A-7). A complete list of agencies and local stakeholders from whom review and comment was requested is provided in Appendix I - Distribution List.

The Chitimacha Tribe of Louisiana is the only federally-recognized Indian tribe with a reservation in the study area. The Alabama-Coushatta Tribe of Texas, the Choctaw Nation of Oklahoma, the Coushatta Tribe of Louisiana, the Chitimacha Tribe of Louisiana, the Jena Band of Choctaw Indians, the Mississippi Band of Choctaw Indians, the Muscogee (Creek) Nation, the Seminole Nation of Oklahoma, the Seminole Tribe of Florida, and the Tunica-Biloxi Tribe of Louisiana may have ancestral ties, or interest in, the study area.

Other agency stakeholders include, but are not limited to:

- Louisiana Department of Natural Resources (LDNR) Office of Coastal Management (OCM)
- Louisiana Department of Wildlife and Fisheries (LDWF)
- Louisiana SHPO, of the Department of Culture, Recreation, and Tourism
- NMFS
- Federally-recognized Indian tribes (collectively referenced as "Tribes")
- USEPA
- NOAA
- FEMA

Local stakeholders include, but are not limited to:

- St. Mary Levee District
- Iberia Levee District
- Sierra Club
- Teche-Vermilion Fresh Water District
- Port of Morgan City
- Port of Iberia
- Municipalities and township associated with Iberia Parish
- Municipalities and township associated with St. Martin Parish
- Municipalities and township associated with St. Mary Parish

1.9 STUDY AUTHORITY, PRIOR REPORTS AND EXISTING WATER PROJECTS

The USACE is completing this study under the following authorities:

H.R. Docket 2767, 20 Sep 2006, Southeast Coastal Louisiana, LA,

> *Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, that, in accordance with section 110 of the River and Harbor Act of 1962, the Secretary of the Army is requested to survey the coast of Louisiana in Iberia, St. Martin, and St. Mary parishes with a view to determine the feasibility of providing hurricane protection and storm damage reduction and related purposes.*

The SCCL was originally titled, Southeast Coastal Louisiana. It was renamed South Central Coast Louisiana to avoid confusion with the Southeast Louisiana urban flood control project covering Jefferson, Orleans, and St. Tammany Parishes.

Funding for the study was authorized by:

BBA of 2018, (Public Law 115-123), Division B, and Subdivision 1, H. R. 1892—13, TITLE IV, CORPS OF ENGINEERS—CIVIL, DEPARTMENT OF THE ARMY, INVESTIGATIONS.Memorandum from R.D. James, Assistant Secretary of the Army (Civil Works), to Deputy Commanding General for Civil and Emergency Operations dated August 9, 2018, SUBJECT: "Policy Guidance on Implementation of Supplemental

Appropriations in the Bipartisan Budget Act of 2018." Enclosure 4, dated July 5, 2018, identifies the studies that will be funded with Supplemental Investigations funds as part of the Long-term Disaster Recovery Investment Plan.

The SCCL study area is a critical area to enhance resiliency to coastal storm surge in the region. Other study efforts along the coast include Southwest Coastal Louisiana, Morganza to the Gulf of Mexico, and Larose to Golden Meadow projects (Table 1-1). Figure 1-4 shows the location of the SCCL study area in comparison to other projects already authorized and in various stages of implementation.

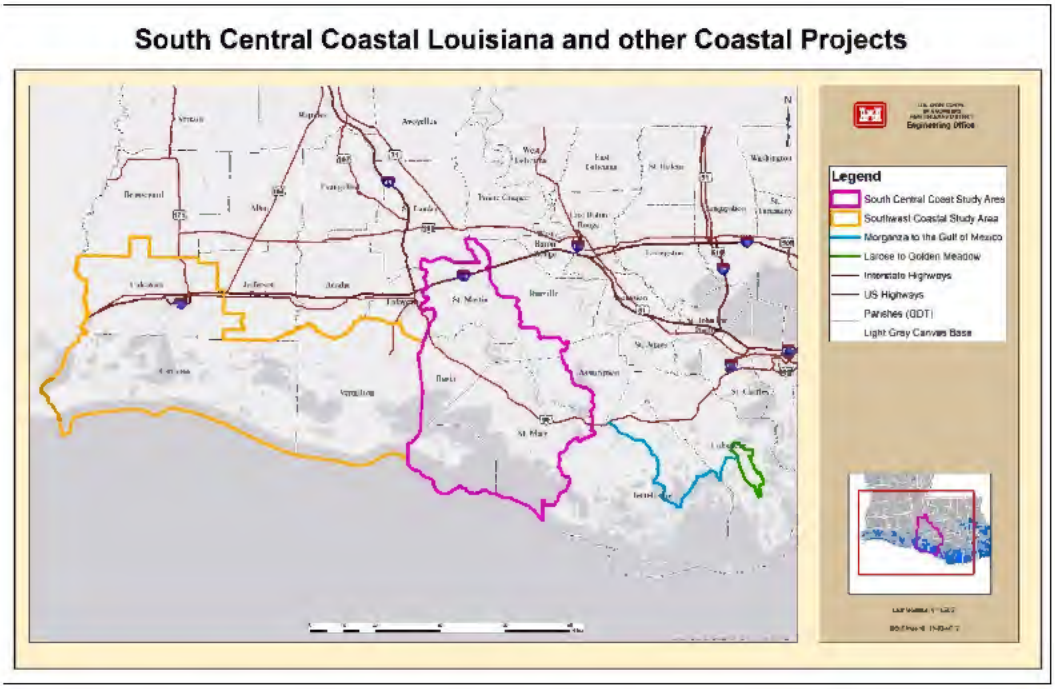


Figure 1-4. Comprehensive Coastal Risk Management Louisiana Coast

The USACE's initial measure evaluation focused on reevaluation of the CPRAB's *South Central Coastal Louisiana Flood Protection Study* (2017) recommendations, as well as potential levee alignments proposed at initial public meetings. These proposed levee alignments run east to west across the study area, and include ring levees near population centers, and the Highway 90 rights-of-way (Figure 1-1). The USACE utilized prior reports and existing data to inform formulation and evaluation of SCCL measures. Prior reports referenced are listed in Table 1-1.

Table 1-1. Prior Relevant Reports and Projects for South Central Coast Study Area

Title of Report/Project	Author	Date	Report Purpose
Flood Control Act of May 15, 1928	U.S. Congress	1928	This legislation directed the USACE to develop and implement the MR&T project, the nation's first long-term flood management program. The Lower Atchafalaya Basin can pass floodwater of 1.5 million cubic

Title of Report/Project	Author	Date	Report Purpose
			feet per second as required by the MR&T.The SCCL feasibility study effort used this report for background on existing federal infrastructure and historic problems related to flood risk within the study area.
Larose to Golden Meadow Hurricane Protection	USACE	1965	The project consists of a ring levee approximately 40 miles in length protecting the areas along the east and west banks of Bayou Lafourche extending from Larose to just south of Golden Meadow. Floodwalls were constructed in areas where the congested nature of improvements and limited right-of-way prevented the construction of levees. The project provides for the construction of navigable floodgates on Bayou Lafourche at the upper and lower limits of the study area. In lieu the eight gravity drainage structures that were authorized as part of the project, the locals chose to pay the additional cost for the pumping stations. The SCCL feasibility study effort used this report for project area background on existing federal infrastructure, lessons learned, and levee design criteria and best practices.
Lower Atchafalaya Basin Floodway System	USACE	1982	The WRDA of 1986 authorized the USACE to develop recreation opportunities within the lower Atchafalaya Basin Floodway System. Facilities include features such as boat landings, campgrounds and an interactive visitor center. New boat landings have been constructed at Simmesport and Myette Point. Additional boat landings are planned for Bayou Sorrel, Krotz Springs, Butte LaRose, and Bayou Pigeon. These sites will include launch ramps, parking, access roads, rest rooms, drinking water, lighting, piers and other features. The SCCL feasibility study effort used this report for project area background on existing federal infrastructure, historic context and existing conditions of recreational facilities in the study area.
Coastal Wetlands Planning, Protection and Restoration Act	USACE	1990	The Coastal Wetlands Planning, Protection and Restoration Act program (CWPPRA or "Breaux Act") provides for targeted funds to be used for planning and implementing projects that create, protect, restore and enhance wetlands in coastal Louisiana. The SCCL feasibility study effort used program lesson learned to inform natural and nature based features, existing conditions and FWOP condition descriptions. Key CWPPRA projects near or within the study area include: Freshwater Introduction South of Highway 82, South White Lake Shoreline Protection Boston Canal/Vermilion Bay Shore Protection, Four Mile Canal Terracing and Sediment Trapping, Little Vermilion Bay Sediment Trapping, Lake Portage Land Bridge, Sediment Trapping at "The Jaws", Bayou Sale Shoreline Protection, Cote Blanche Hydrologic Restoration, Freshwater Bayou (FWB) Bank Stabilization, FWB Wetland Protection, Pecan Island Terracing, Oaks/Avery Canal Hydrologic Restoration, Marsh Island Hydrologic Restoration, East Marsh Island Marsh Creation, Cole's Bayou Marsh Restoration, Big Island Mining, Atchafalaya Sediment Delivery.
Port of Iberia	USACE	2005	The Port of Iberia project was authorized by WRDA 2007 to deepen the existing navigation channels to a depth of 16 feet between the Port and the Gulf of Mexico. These channels include Commercial Canal, portions of the GIWW and FWB. This project has been authorized but not constructed. The SCCL feasibility study effort used this report to inform existing condition, problems and opportunities, and FWOP condition descriptions.
St. Mary Levee District Master Plan	St. Mary Parish	2010	The plan identifies parish hurricane protection, backwater flooding, and related needs such as saltwater intrusion. The SCCL feasibility study effort used this report to inform existing condition, problems and opportunities, and FWOP condition descriptions.

Title of Report/Project	Author	Date	Report Purpose
Breaux Bridge Comprehensive Long-Range Resiliency Plan	Breaux Bridge, LA	2012	A planned redevelopment in targeted areas to manage growth and ensure long-term resilience. The SCCL feasibility study effort used this report to inform existing condition, problems and opportunities, potentia measures, and FWOP condition descriptions.
Iberia Parish Hurricane Protection Master Plan	Iberia Parish	2012	Comprehensive plan to provide protection from flooding, saltwater intrusion, tidal and storm surges associated with tropical storms and hurricanes for the lands and residents of Iberia parish. SCCL feasibility study effort used this report to better understand existing condition, problems and opportunities.
Final Issue Evaluation Study Report: Design Criteria site-adaptation for proposed Morganza to the Gulf Levee System	USACE	2013	Issue Evaluation Study Report summarizes the findings of the Phase II evaluation of the proposed Morganza to the Gulf storm-surge risk reduction project. This project aims to protect people and property as well as the remaining fragile marsh from hurricane storm surge in the vicinity of Houma, Louisiana. The SCCL feasibility study effort used this report to inform levee design and cost considerations.
Cote Blanche Freshwater and Sediment Introduction, and Shoreline Protection Project, St. Mary Parish, Louisiana Phase 1- Planning, Engineering, and Design	USACE on Behalf of the Chitimacha Trib of Louisiana	2014	Recommendations for the Cote Blanche Project located in the Teche Vermilion Basin for the purpose of increasing freshwater and sediment input from the GIWW into interior marshes. The SCCL feasibility study effort used this report to inform existing condition, problems and opportunities.
Southwest Coastal Louisiana Final Feasibility Report and Programmatic EIS	USACE	2015	The SWC project was authorized for implementation in WRDA 2016. Southwest Coastal Louisiana NED project will provide nonstructural hurricane and storm surge damage risk reduction measures, in the 4,700 square mile study area located in Calcasieu, Cameron, and Vermilion Parishes in southwest Louisiana. USACE received $810,000 in FY 2018 Workplan funding. No funds were received in FY 2019 and 2020. The NER features addressed in the feasibility report will be implemented pursuant to the LCA project authorization. The SCCL feasibility study effort used formulation, nonstructural implementation and economic evaluation lesson learned in the study process.
CPRAB South Central Coast Louisiana Flood Protection Study	CPRAB	2017	Coastal Protection and Restoration Authority of Louisiana funded a flood risk and coastal storm risk reduction study to determine the feasibility, cost, impact, and conceptual design of risk reduction measures. The Study's ROD was signed April 2016 and Chief's Report approved July 2016. The SCCL feasibility study effort used this report for primary data on measure development, cost and design criteria.
Louisiana's Comprehensive Master Plan	CPRAB	2017	Following Hurricanes Katrina and Rita in 2005, the Louisiana Legislature created the CPRAB and tasked it with coordinating the local, state, and Federal efforts to achieve comprehensive coastal protection and restoration. CPRAB developed a master plan to guide efforts toward a sustainable coast. SCCL feasibility study effort used this report to inform existing condition, problems and opportunities.
Restoring the Mississippi River	Restore the Mississippi Rive	2018	Recommendations for Coastal Restoration Projects and Programs in Louisiana. The SCCL feasibility study effort used this report to inform

Title of Report/Project	Author	Date	Report Purpose
Delta	Delta		existing condition, problems and opportunities.
Iberia Parish Hazard Mitigation Plan	Iberia Parish	Ver. 2015	A hazard mitigation plan is being adopted by Iberia Parish. This plan includes identification, prioritization of risks and action plans to reduce risk. Goal 5 of the Hazard Mitigation plan is specific to reducing impacts to hurricanes, storm surge and coastal erosion. The SCCL feasibility study effort used this report to inform existing condition, problems and opportunities, and FWOP conditions. Additionally, document was utilized in plan formulation to assist with understanding local risk factors and to ensure alignment of RP with local efforts. St. Mary and St. Martin Parishes are in the process of developing a Hazard Mitigation Plan.
Louisiana State Hazard Mitigation Plan	Office of Homeland Security and Emergency Preparedness	2019	This Louisiana Hazard Mitigation plan was version 2014; updated in 2019) includes identification, prioritization of risks and action plans to reduce risk. Goal 4 of the Hazard Mitigation plan is specific to reducing impacts through mitigation of repetitive and severe loss of properties. The document was utilized in plan formulation to assist with understanding local risk factors and to ensure proposed measures and recommended action were in alignment with local efforts.
Annual Compliance Inspection for Morgan City Federal Levee	USACE	2018	This inspection rating represents the USACE evaluation of operations and maintenance of flood damage risk reduction system and may be used in conjunction with other information for a levee system evaluation. The SCCL feasibility study effort used this report to inform existing condition, problems and opportunities, and FWOP conditions for the Morgan City levees within the study area.
Behavioral Analysis for Southwest Louisiana Hurricane Events	Stephenson Disaster Management Institute	2019	This study goal was to understand previous evacuation behavior and potential evacuation behavior during future hurricane events for the residents of southwest Louisiana. The study determined that southwest Louisiana residents are "very experienced" in dealing with hurricanes with 95% of those sampled likely heed official instruction when given a mandatory evacuation order. The SCCL feasibility study effort used this report to inform assumptions for future without and future with project evacuation behaviors.

Section 2
Affected Environment

2.1 INTRODUCTION

The USACE inventoried the applicable social, economic, and environmental factors for the study area (St. Martin, Iberia, and St. Mary Parishes, as well as the affected area for some resources described in this section). The study area includes an array of private, local, state and federally-managed lands, including the Gulf of Mexico, gulf coastal areas, coastal marshes, Atchafalaya River and floodplain, and adjacent lands (agriculture, urban, and wildlife habitat). The affected area includes the area outside the study area that may be directly or indirectly affected by the Federal action and not merely the immediate area involved in the action.

The USACE used applicable social, economic, and environmental factors as the foundation of the analysis, to evaluate and compare alternatives and ultimately select USACE's RP. These factors establish a baseline to measure the proposed action's impacts.

The study area, as described in Section 1, also includes:

- constructed public and private facilities within the study area;
- areas in the study area receiving flood inundation.

No new surveys or data collection occurred during the planning phase. Finally, the NEPA regulations state NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail (40 CFR 1500.1(b)). The USACE team focused on resources having the greatest potential for environmental impact.

This section describes the baseline conditions existing in the study area and affected area. A summary of key resources and future conditions is included in Section 5 for alternative comparison purposes.

2.2 FUTURE WITHOUT PROJECT CONDITION KEY ASSUMPTIONS

The following resource trend projections were determined to be significant to the action in question (40 CFR 1500.1(b)). Additional assumptions and support are presented under each resource section. All projections are forecasted over a year period of analysis (as defined in ER 1105-2-100). Key assumptions include the following:

- Human populations will slightly decrease; however, household formation is predicted to show minor increases;
- Communities currently experiencing coastal flooding will experience increased flood frequency and damages as a result of RSLR;
- Subsidence will continue at present rates, resulting in landward movement of marine conditions;
- Evacuation corridor Hwy-90 ("Future I-49") will remain at existing elevation and risk levels may increase with RSLR;
- Parish evacuation plans will continue to be implemented and updated with new information as developed;
- Parish hazard mitigation plans will continue to be implemented and updated with new information as developed;
- Project area sedimentation and shoreline erosion would continue into the future. Near the Wax Lake Outlet, land accretion should continue as a result of the sedimentation;
- Coastal shoreline, barrier islands, and gulf beaches will continue to erode at an existing high rate;
- St. Martin, St. Mary, and Iberia parishes will continue to implement existing robust emergency action plans;
- St. Martin, St. Mary, and Iberia Parishes will continue to implement existing FRM infrastructure in accordance with existing operation manuals;

- MR&T flood risk reduction systems are assumed to provide authorized risk reduction levels.
- Normal operation and maintenance (O&M) practices are assumed to be performed over the period of analysis;
- Evacuation of warehouse contents will continue to be limited due to a variety of factors that include uncertain coastal storm paths, limited warning time for evacuation, significant volume of warehouse contents to be evacuated, limited evacuation routes, limited short-term storage capacity at destination, congesting limited egress routes with semi-trucks, and forcing laborers to be working in a hazardous areas to evacuate contents instead of evacuating themselves to safety.

2.3 RESOURCES NOT EVALUATED IN DETAIL

The USACE considered relevant environmental resources that would potentially be impacted by the proposed alternatives and eliminated resources from further evaluation that were not in the area of potential effect or would not be impacted by any of the alternatives. These resources include:

- geology and topography,
- wild and scenic rivers (there are no designated wild and scenic rivers in or near the study area),
- mineral and energy resources,
- essential fish habitat (EFH)

The USACE focused on information gathered from the study area and the area of potential effect.

2.4 RELEVANT RESOURCES

The USACE focused its evaluation on resources potentially affected by the alternatives. This section briefly describes the following resources' current condition. Appendix A-1: Environmental Resources describes some of these resources in greater detail and includes relevant maps.

- Hydrology
- Floodplains
- Navigation and Public Infrastructure
- Socio-economics
- Land Use
- Aquatic Resources (coastal shorelines, vegetation and estuaries, invasive plant species, wetland loss, and rare, unique, and imperiled vegetative communities)
- Fish and Wildlife Resources
- Threatened/Endangered Species and Other Protected Species of Concern
- Cultural, Historic, and Tribal Trust Resources
- Environmental Justice

- Soils
- Aesthetics and Visual Resources
- Water Quality and Salinity
- Air Quality
- Noise
- HTRW
- Sustainability, Greening, and Climate Change

The period of analysis is 50 years (2025 - 2075).

2.5 GENERAL SETTING

The study area (Figure 1-1) is located in South Central Louisiana and includes all of St. Mary, Iberia, and St. Martin Parishes, encompassing approximately 2,966 square miles (mi^2). St. Martin Parish is located in the northern section of the study area and was split into two non-contiguous areas when Iberia Parish was created in 1868. Iberia Parish is 1,031 mi^2 in size (574 mi^2 of land and 456 mi^2 of water). St. Mary Parish is 1,119 mi^2 (555 mi^2 of land and 564mi^2 of water). These parishes are primarily rural with navigation, agriculture, and oil industry influences.

2.6 GEOMORPHIC AND PHYSIOGRAPHIC SETTING

The study area contains a mosaic of extensive coastal marshland, natural ridges, forests, and agriculture (primarily sugar cane, soybeans, and rice). Scattered in the study area are salt domes. Salt domes are largely subsurface geologic structures consisting of a vertical cylinder of salt embedded in horizontal or inclined strata. In the broadest sense, the term includes both the core of salt and the strata surrounding and domed by the core. Major accumulations of oil and natural gas are associated with salt domes in the United States. Overbank flood sedimentation of rivers in southeast Louisiana formed natural ridges (Fisk, 1944). The rivers involved in creating these natural levees were prior tributaries of the Mississippi River.

2.7 NATURAL ENVIRONMENT GENERAL SETTING

This riverine ecoregion extends from southern Illinois, at the confluence of the Ohio River with the Mississippi River, south to the Gulf of Mexico. The Mississippi River watershed drains all or parts of 31 states, 2 Canadian provinces, and is approximately 1,243,000 $miles^2$ before the river finally reaches the Gulf of Mexico. The Mississippi Alluvial Plain is mostly a broad, flat alluvial plain with river terraces, swales, and levees providing the main elements of relief. Soils are typically finer-textured and more poorly drained than the upland soils of adjacent ecoregions. The widespread loss of forest and wetland habitat has affected wildlife and reduced bird populations, although it is still a major bird migration corridor. The batture lands and the Mississippi River are hydrologically connected. These lands are flood-prone and contain remnant habitat for "big river" species (e.g., pallid sturgeon) as well as riverfront plant communities. The study area is in five sub-ecoregions to the Mississippi Alluvial Plain (See Appendix **A**-1: Environmental Resources for a large map of the sub-ecoregions).

2.8 CLIMATE

The climate is subtropical marine with long humid summers and short moderate winters. The average high and low temperatures are 78.8 and 58.8°F respectively, with August being the warmest and January the coolest. Average annual rainfall is 60 inches; with June the wettest and March the driest month (Your Weather Service, 2018). During the summer, prevailing southerly winds produce conditions favorable for afternoon thundershowers. Frontal movements producing squalls and sudden temperature drops occur during the colder seasons. River fogs are prevalent in the winter and spring when the temperature of the major water bodies is somewhat colder than the air temperature. Since 1856, a total of 63 hurricanes have made landfall within 65 nautical miles of Morgan City, Louisiana (NOAA, 2018). Since 2018, Hurricanes Barry and Laura affected the study area.

2.9 RESOURCES

2.9.1 Water Environment (Hydrology and Hydraulics) Overview

The study area intersects five hydrologic basins: Bayou Teche, Vermilion, Atchafalaya, Terrebonne, and Lower Grand (Figure 2-1). Bayou Teche and Vermilion are two sub-basins in the combined Teche-Vermilion system. The Atchafalaya and Teche-Vermilion Basins contain the dominant hydrologic features while the western portions of the Lower Grand and Terrebonne Basins are peripherally relevant. Appendix A-1: Environmental Resources contains further details about Lower Grand and Terrebonne Basins, and the study area's five hydrologic basins. The study area experiences a diurnal tidal signal with one daily high and low tide. The tidal range in the Atchafalaya Bay near the Wax Lake outlet is approximately 2.5 feet. (NOAA 2018).

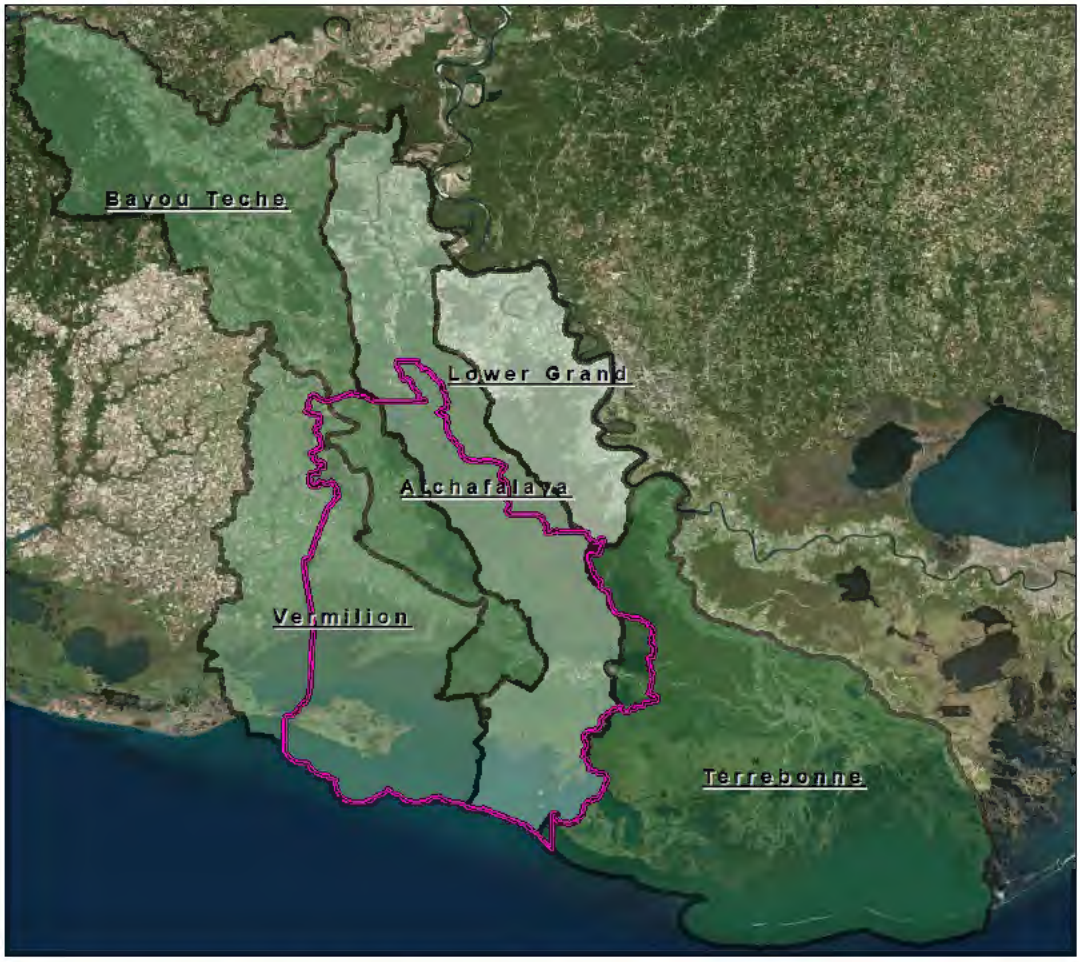


Figure 2-1. Schematic Delineating the Individual Basin Boundaries *Overlaid with the Study Area*

2.9.1.1 Riverine

The Atchafalaya Basin contains the Atchafalaya River (137 miles long), a large freshwater feature that spans the entire study area (north to south). The basin begins at the Old River Control Structure located upstream of Simmesport and ultimately drains into the Gulf of Mexico.

The Atchafalaya receives approximately 30 percent of the combined latitudinal flow of the Mississippi and Red Rivers, averaging 225,000 cfs. The floodway, bordered by large Federal river levees, directs flow south towards the Atchafalaya Bay near Morgan City or via the Wax Lake outlet between Centerville and Calumet.

The Atchafalaya Floodway largely mitigates for economic damages from riverine flooding. A majority of structures affected within the 50 year flood extent are located on land owned that is government ownership. Figure 2-2 illustrates the 50 year flood extent and affected structures within the Atchafalaya Floodway. Remaining private structures generally have an existing easement. Economic damages are not 100 percent mitigated by the Atchafalaya Floodway, measures designed to further reduce risk from riverine

flooding would result in relatively low benefits over the 50-year period of analysis due to the low return flood frequency and resulting lower probability of structural damages. Therefore, solutions associated with residual riverine damages were not pursued. Details regarding riverine flooding frequencies within the Atchafalaya Floodway are discussed in Appendix C, Hydraulics, Hydrology, and Climate Preparedness and Resiliency.

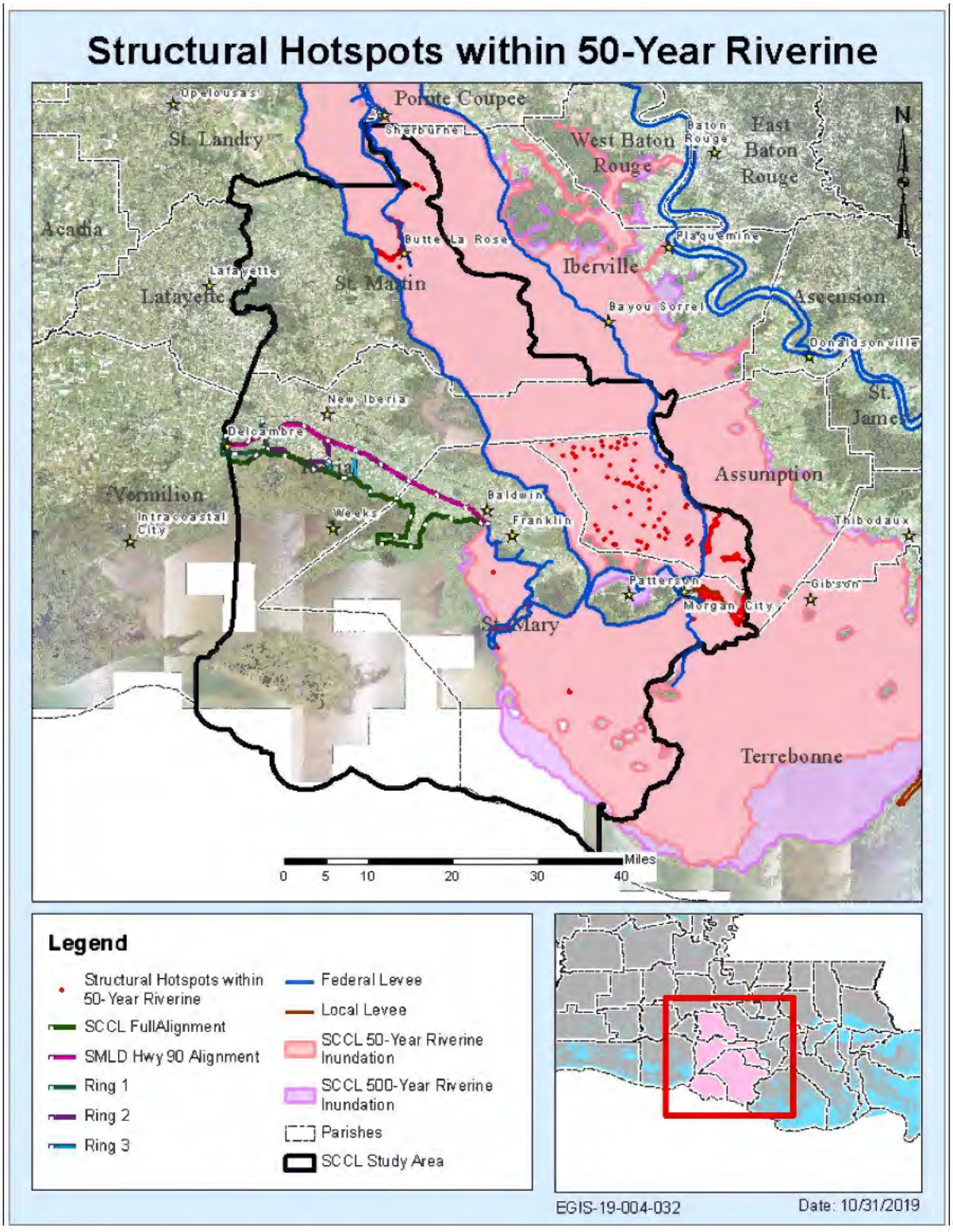


Figure 2-2. Atchafalaya Riverine 50-Year Flooding Extent with Affected Structures

2.9.1.2 Storm Surge

Coastal Louisiana experiences localized flooding from excessive rainfall events. However, the primary cause of flooding events resulting in significant economic damages is storm surge from hurricanes and tropical storms. Storm surges associated with Category 2 or higher hurricanes (Barry, Lili, Rita, Gustav, and Ike) greatly impacted the study area. The storms inundated structures and resulted in billions of dollars in damages to south central Louisiana. Hurricane storm surge also causes significant permanent damage to natural flood barriers such as wetlands. Hurricane surge forms ponds in stable contiguous marsh areas and expands existing small ponds. Hurricane surges also remove material in degrading marshes (Barras, 2007). Fresh and intermediate marshes appear to be more susceptible to surge impacts, as observed in Barras (2006).

Appendix C has additional information on the Category 2 or higher hurricanes of relevance to the study area and Appendix A-1: Environmental Resources details storms of record within the study area. Figure 2-3 shows current condition (2026) storm surge depth during 25 year storm events.

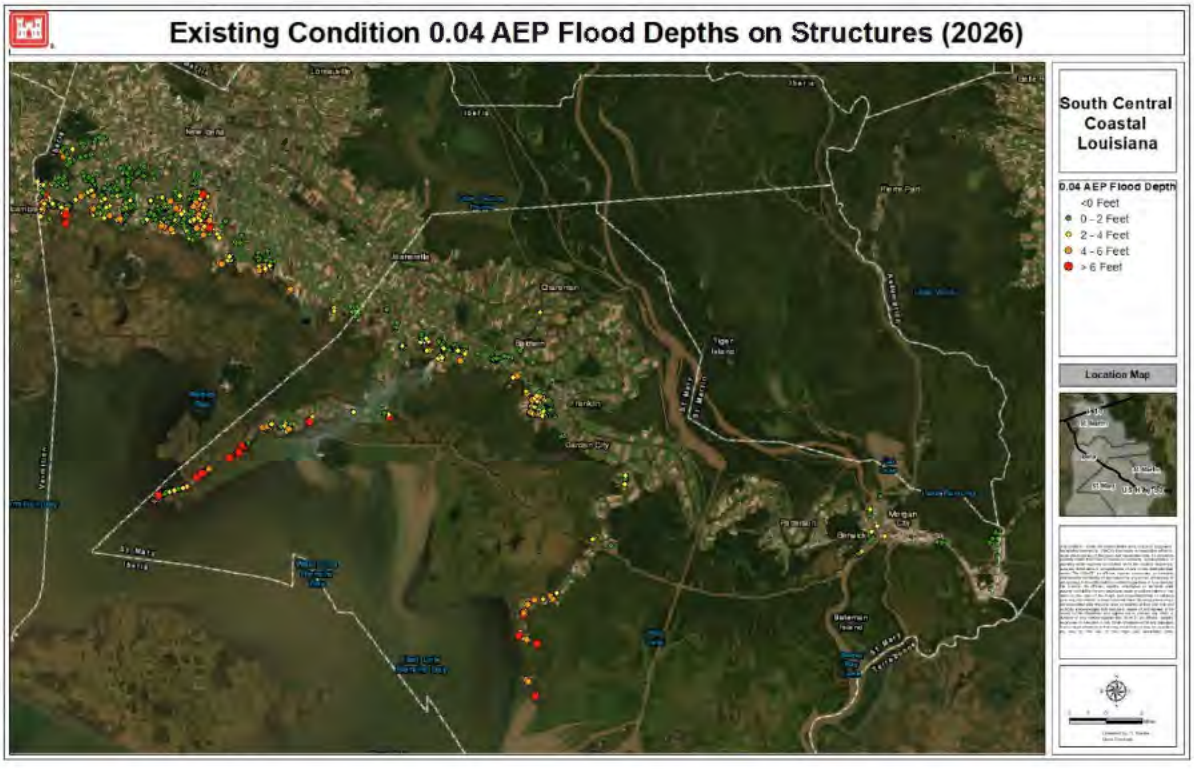


Figure 2-3 SCCL Study Area 2026 Storm Surge Depths during 25 Year Storm Events

2.9.1.3 Relative Sea Level Rise

In coastal Louisiana, RSLR is the term applied to the local change in sea level relative to the elevation of the land at a specific point on the coast. The RSLR is a combination of the change in global sea level and the change in land elevation. According to the IPCC, 2007, the global mean sea level rose at an average rate of about 1.7 mm/yr during the 20th century. The predicted average rate RSLR for the South Central Coast project area is shown on Figure 2-4. Recent climate research documented global warming during the 20th century and predicted either continued or accelerated global warming for the 21st century and possibly beyond (IPCC, 2007).

Land elevation change can increase (accrete) or decrease (subside). Land elevations decrease due to natural causes, such as compaction and consolidation of historic deposits and faulting, and human influences such as sub-surface fluid extraction and drainage for agriculture, flood protection, and development. Forced drainage of wetlands results in lowering of the water table resulting in accelerated compaction and oxidation of organic material. Coastal Louisiana has forced drainage. Land elevations increase because of sediment accretion (riverine and littoral sources) and organic deposition from vegetation. Vertical accretion in most of the study area, however, is insufficient to offset subsidence, causing an overall decrease in land elevations. The combination of subsidence and global sea level rise is likely to cause the landward movement of marine conditions into estuaries, coastal wetlands, and fringing uplands (Day and Templet, 1989; Reid and Trexler 1992).

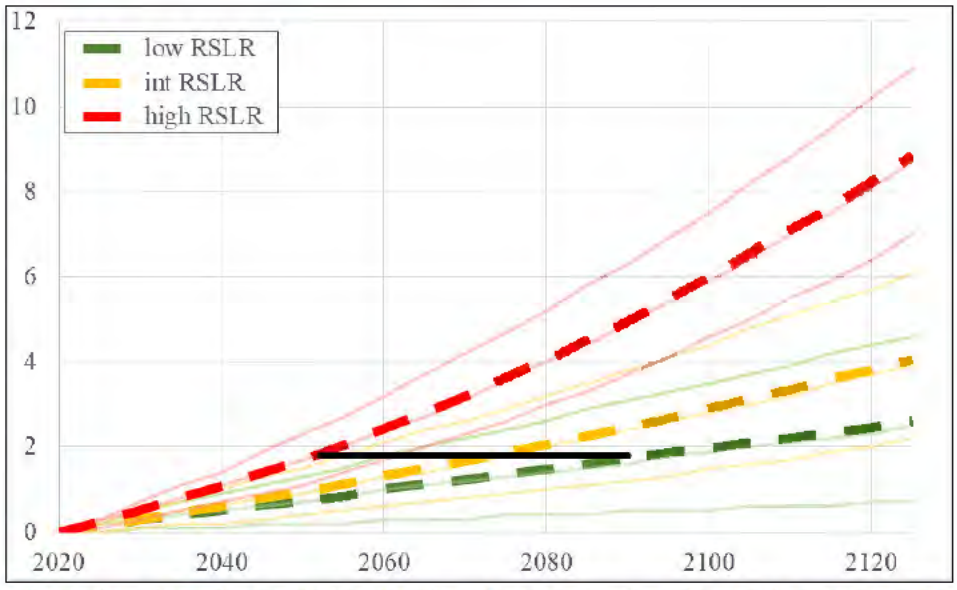


Figure 2-4. Relative Sea Level Rise for the South Central Coast Louisiana Average rates from gages (dotted); individual rates from gages (solid)

2.9.1.4 Floodplains

Natural Floodplain. Floodplains are the low, flat, periodically inundated lands adjacent to rivers and are subject to the erosion and deposition processes. As distinguished from the floodplain, a river's floodway is a dry zone typically between levees, designed to convey floodwaters. It is only during and after major flood events the connections between a river, its floodway and its floodplain become more apparent. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. In addition, the floodplain represents a natural filtering system, with water percolating back into the ground and replenishing groundwater. The Atchafalaya subbasin, which is also a floodplain, is located between two north-south trending flood protection levees located just east of Lake Fausse Pointe and near the eastern end of Iberia Parish. The Atchafalaya River (Figure 2-5) supports a variety of commercial and recreational activities and provides habitat for a diverse array of plants and wildlife. Most of the water moving through the Atchafalaya subbasin in Iberia Parish eventually exits the basin through the Wax Lake Outlet, located south of Iberia Parish in St. Mary Parish.

Regulatory Floodplain. For land use planning purposes, the regulatory floodplain includes all lands within reach of a 100-year flood. The FEMA produces floodplain maps, defining the 100-year (or "regulatory") floodplain to implement the NFIP. Figure 2-6 shows the FEMA 100-year and 500-year floodplains.

A common misconception about the 100-year flood is it represents the peak flow from historical records, or it will occur once every 100 years. In fact, a 100-year flood has a 26 percent chance of occurring during a 30-year period, the length of many home mortgages. The 100-year flood is a statistically derived regulatory standard used by Federal agencies, and most states, to administer floodplain management programs. Acres of floodplain within each type, as defined by FEMA, are listed in Table 2-1.

The probability and extent of flooding are increasing throughout the floodplains in the affected study area due to RSLR and changes in precipitation due to climate change. The FEMA may change the regulatory floodplains based on changes in flood frequency.

Of note, VE Zone floodplains are located along coasts and are subject to additional hazards due to storm-induced velocity wave action. The zone designation and the base flood elevation (BFE) are critical factors in determining what requirements apply to a building and, as a result, how it is built. The NFIP has minimum requirements for buildings built in Zone VE but if those engineering and review requirements are met, elevation of residential structures is allowed.

Table 2-1. Acres of Floodplain Type within the Study Area

Flood Zone	Acreage	% of Study Area
A 100Year Floodplain	613,102	32.298%
AE 100Year floodplain	285,386	15.034%
AH 100Yr Shallow Floodplain	66	0.003%
AO 100Yr Shallow Floodplain	167	0.008%
Open Water	479,389	25.254%
VE Coastal Floodplain	296,561	15.623%
X 500YR	45,877	2.417%
X LEVEE	83,851	4.417%
Minimal Flood Risk	93,852	4.944%

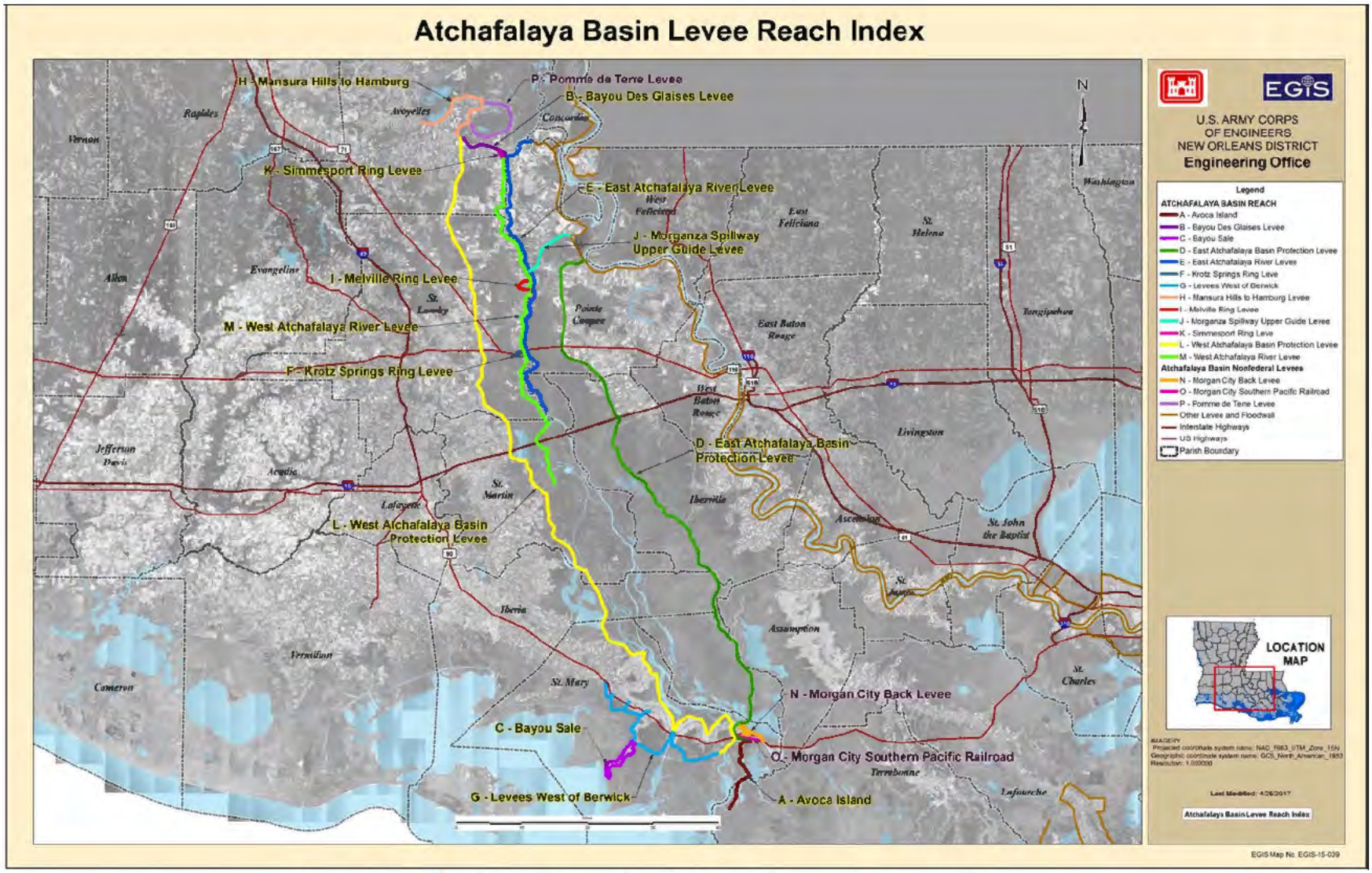


Figure 2-5. The Atchafalaya River's Floodplain and Associated Levees

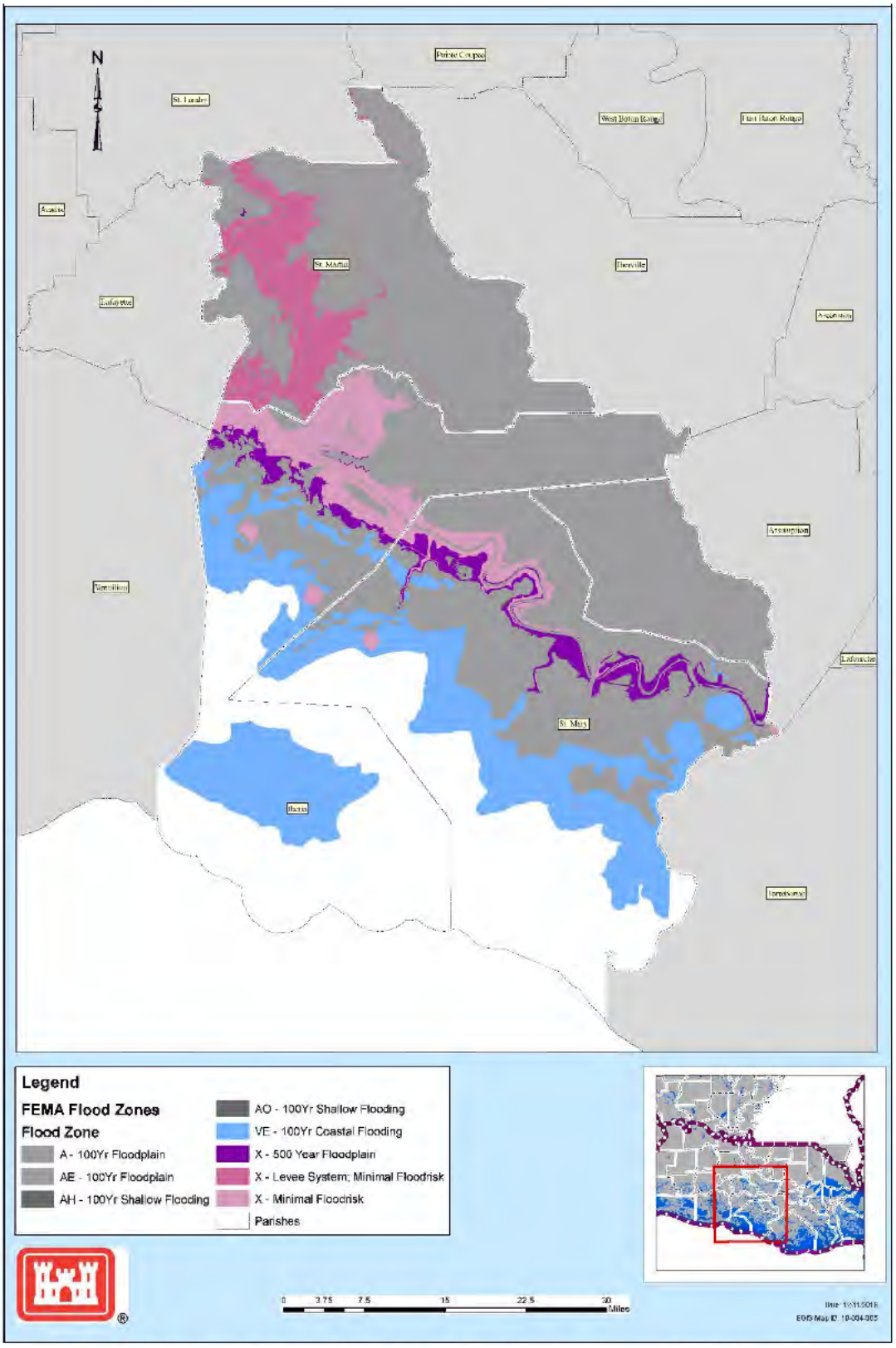


Figure 2-6. South Central Coast, LA – FEMA 100-Year and 500-Year Floodplains

2.9.2 Navigation and Public Infrastructure

Key existing infrastructure at risk from storm surge include:

- GIWW and Bayou Teche
- Evacuation routes for SCCL residents and the greater New Orleans area (Hwy 90/future I-49 corridor)
- Port of West St. Mary, Port of Iberia, Port of Morgan City
- Keystone Lock and Dam
- Berwick Lock and Bayou Boeuf Lock
- Wax Lake Outlet and Pumping Station
- Harry P. Williams Memorial Airport
- Major transportation corridors

Flood Risk Reduction Structures. The study area has significant levees, pumping stations, canals, and other constructed features to reduce the risk of Atchafalaya River flood damages. Figure 1-2 shows the key federally-constructed structures in the study area. The completion of the 1940s levees accentuated the natural filling of the Atchafalaya Basin with sediment. The South Central Coast study area contains the following levee systems, or segments:

- Southern West Atchafalaya River Levee,
- Southern West Atchafalaya Basin Protection Levee,
- Southern East Atchafalaya River Levee,
- Levees West of Berwick,
- Bayou Sale Levees,
- Avoca Island Levee
- Morgan City's Back Levee and floodwall,
- Southern Pacific Railroad Levee.

The east Atchafalaya Basin levee and the west Atchafalaya Basin levee are two main reaches that provide flood risk reduction for the areas outside of the floodway. After the levees were constructed, sediment was directed into an area about one-third the size of the original basin.

The Levee Safety Action Classification (LSAC) is a system designed to take into account the probability of the levees being loaded (Hazard), existing condition of the levee, the current and future maintenance of the levee (Performance), and the consequences if a levee were to fail or be overwhelmed. Total flood risk can be thought of as the sum of all the flood risk experienced by all the individuals in the leveed area. LSAC classifications range from class I (urgent and compelling) to class V (normal). All existing levees and structures within the study area have an LSAC classification of II (urgent), as of the latest inspections and ratings.

During the mid-19th century, manmade channel alterations, including the removal of a large logjam and dredging, permanently connected the Atchafalaya River to the Mississippi River. From then until the completion of the Old River Control Structure in

1963, the Mississippi was increasingly diverting flow into the shorter and steeper path of the Atchafalaya River. Approximately, 30 percent of the latitudinal flow water from the Mississippi, Red, and Black Rivers is presently diverted annually into the Atchafalaya at the Old River Control Structure. This flow diverts on average 25 percent of the Mississippi River flow down the Atchafalaya.

During the period of 1960–1980, oil and gas exploration and development in Louisiana increased dramatically. Dredging occurred in numerous large access canals and pipeline canals through deep swamp areas, across bayous, and across the Atchafalaya River. In some areas of the basin, there are 1.24 miles or more of access canals to every 0.75 miles of natural bayou.

2.9.3 Socio-Economics (The Human Environment)

The study area encompasses three parishes: Iberia, St. Martin, and St. Mary. The parish seats are New Iberia, St. Martinville, and Franklin, respectively.

2.9.3.1 Population and Housing

Table 2-2 shows the population trend in the three-parish area from 1970 to 2010 and projections through 2040. Population in the three parishes is predicted to be steady through 2020 but decrease through 2040. Statewide population is predicted to rise over this period. The trend in household formation, shown in Table 2-3, is predicted to level off by 2020 and show little growth through the year 2040.

Table 2-2. Population in the Study Area (1000s)

Parish	1970	1980	1990	2000	2010	2020	2030	2040
St. Martin	57.48	64.32	68.25	73.17	73.25	73.27	68.99	65.05
St. Mary	32.50	40.52	44.12	48.58	52.26	54.27	53.29	52.23
Iberia	60.84	64.55	57.99	53.38	54.54	52.63	51.57	50.84
State Total	3650.20	4226.70	4221.53	4471.89	4545.0	4732.42	4816.69	4868.18

U.S. Census Bureau; Moody's Analytics (ECCA) Forecast

Table 2-3. Number of Households in the Study Area (1000s)

Parish	1970	1980	1990	2000	2010	2020	2030	2040
St. Martin	15.62	20.10	22.89	25.40	26.81	28.02	27.61	26.95
St. Mary	8.44	12.27	14.68	17.20	19.27	20.90	21.47	21.78
Iberia	16.10	20.13	19.42	19.31	20.44	20.60	21.13	21.58
State Total	1053.61	1418.77	1499.82	1660.62	1734.57	1887.22	2010.60	2104.10

U.S. Census Bureau; Moody's Analytics (ECCA) Forecast

2.9.3.2 Employment, Business, and Industrial Activity

Nonfarm employment is expected to decrease by the year 2040 (U.S. Census Bureau, 2018). The leading employment sectors are trade, transportation, utilities, and government, local government, and office using industries. The unemployment rate in all three parishes is generally higher than the State of Louisiana unemployment rate (Table 2-4).

Table 2-4. Unemployment Rates in the Study Area

Parish	1990	2000	2010	2020	2030	2040
St. Martin	5.62	5.56	7.95	7.81	8.03	7.60
St. Mary	6.28	7.39	9.41	9.05	8.90	8.49
Iberia	4.66	5.80	8.61	9.31	9.57	9.06
State Total	6.20	5.30	7.97	6.88	7.06	6.71

U.S. Census Bureau; Moody's Analytics (ECCA) Forecast

2.9.3.3 Public Facilities and Services

Public facilities and services have historically grown to meet population demands. The area includes a mixture of community centers, schools, hospitals, airports, colleges, and fire protection. Trends are expected to mirror population trends.

2.9.3.4 Transportation

The transportation infrastructure includes major roads, highways, railroads, and navigable waterways that have developed historically to meet the needs of the public. Interstate 10 (I-10), an east-west bi-coastal thoroughfare that connects Houston and Baton Rouge, crosses the northern part of the area and is a primary route for hurricane evacuation and post-storm emergency response. US-90, another evacuation and emergency response route, is located south of I-10.

The Louisiana Department of Transportation and Development is currently working to extend I-49 from its current terminus in Lafayette south and east to New Orleans along the existing Hwy 90 corridor. "Future I-49" signage is visible along this portion of the corridor, although construction has yet to begin. Cost has been an ongoing issue. The

impetus to reclassify Hwy 90 to I-49 is safety. The Hwy 90 is considered the most dangerous highway in Louisiana and the 13th in the nation. Heavy use and the lack of controlled access onto Hwy 90 are contributing factors to accidents. Upgrading US 90 to interstate standard would limit access to the roadway, easing travel between Lafayette and New Orleans.

The State of Louisiana Governor's Office of Homeland Security and Emergency Preparedness maintains comprehensive evacuation plans for each parish within the study area. Plans are updated every two years per La. R.S. 29:729 (B). Multiyear training and exercise plans are required for each parish and training and exercise workshops completed annually. Additional requirements and details can be found here: https://gohsep.la.gov/Portals/0/Documents/Resources/Parish-OHSEP-Requirements-asof09192019.pdf.

The study area is included in Phase I and Phase II of a phased evacuation. Evacuation routes and phased evacuation maps are located at: https://maps.redcross.org/website/maps/images/Louisiana/LA_state1_evac.pdf . Phase 1 primarily covers residents south of the Hwy-90 corridor and notification is provided 50 hours before onset of tropical storm winds. Phase II largely covers residents north of Hwy-90 corridor notification is provided 40 hours before onset of tropical storm winds.

Behavioral Analysis for Southwest Louisiana Hurricane Events study performed by Stephenson Disaster Management Institute in 2019, concluded that within southwest coastal area the population is "very experienced in dealing with hurricanes". Further the study found 95% of people sampled would likely heed officials instructions when given a mandatory evacuation. The choice to evacuate was largely based on the strength of the storm. The future condition assumes that this rate will continue.

2.9.3.5 Airports

Acadiana Regional Airport, with an 8,002-foot long, 200-foot wide concrete runway and fully instrumented airfield, is located just north of US Highway 90 (the future Interstate 49 corridor) and just south of Louisiana Highway 182. The airport also features direct rail access, a 5,000-foot lighted water runway for amphibious aircraft, and a rail-to-truck offloading facility.

The airport's close proximity to the Port of Iberia and its 16-foot-deep main navigation channel spotlights the intermodal transportation available.

The Harry P. Williams Memorial Airport is approximately 8 miles west of Morgan City, St. Mary Parish. The airport serves the energy exploration and production industry with a helicopter emphasis.

In September 2005, after Hurricanes Katrina and Rita devastated virtually the entire southern part of Louisiana, Harry P. Williams Memorial Airport played a vital role in rescue and recovery operations. The Perry Flying Center became a staging point for Coast Guard and other military rescue aircraft during the massive rescue operation in

the New Orleans area. After Hurricane Rita passed, Harry P. Williams Memorial Airport served as a hub for Navy and Marine rescue aircraft for many days.

2.9.3.6 Community and Regional Growth (Income)

Community and regional growth primarily track population and employment trends described in the preceding sections. Table 2-5 shows per capita growth in income since 1970 and predictions through the year 2040.

Table 2-5. Per Capita Income, 1970-2040

Parish	1970	1980	1990	2000	2010	2020	2030	2040
St. Martin	2,142	6,966	10,829	17,912	32,060	45,678	70,747	110,861
St. Mary	2,919	8,740	12,716	21,608	35,400	43,991	59,886	82,423
Iberia	2,653	8,863	13,517	20,423	34,986	43,427	60,068	83,442
State Total	170,960	477,970	828,524	1,295,073	2,123,377	2,842,042	4,017,923	5,786,992

U.S. Census Bureau; Moody's Analytics (ECCA) Forecast

2.9.3.7 Community Cohesion

Community cohesion is based on the characteristics that keep the members of the group together long enough to establish meaningful interactions, common institutions, and agreed upon ways of behavior. These characteristics include race, education, income, ethnicity, religion, language, and mutual economic and social benefits. The area is comprised of communities with a long history and long-established public and social institutions including places of worship, schools, and community associations.

2.9.3.8 Recreation Resources

This resource is institutionally important because of the Federal Water Project Recreation Act of 1965, as amended, and the Land and Water Conservation Fund (L&WCF) Act of 1965, as amended. Recreational resources are technically important because of the high economic value of these recreational activities and their contribution to local, state, and national economies. Recreational resources are publicly important because of the high value that the public places on fishing, hunting, and boating, as measured by the large number of fishing and hunting licenses sold in Louisiana, and the large per-capita number of recreational boat registrations in Louisiana.

The entire study area is within the Atchafalaya National Heritage Area and is comprised of ecosystems having national significance. The Atchafalaya Basin Floodway System, situated within the Atchafalaya National Heritage Area, contains one of the largest bottomland hardwood (BLH) forest swamps in North America including significant cultural, historic, scenic, and recreational resources. This Inland Swamps ecoregion of Louisiana is a haven for wildlife, providing numerous consumptive and non-consumptive

recreation opportunities. Consumptive recreation includes hunting, fishing for freshwater and saltwater species, and trapping alligators and nutria. Non-consumptive recreation includes wildlife viewing, sightseeing, boating, camping, and environmental education/interpretation. The study area extends into Deltaic Coastal Marshes and a Barrier Islands ecoregion dominated by brackish and saline marshes. The connectivity throughout this area incorporates the following existing recreational features: private boat launches, public boat launches, public campgrounds, paddling/canoe trails, and shooting ranges. This connectivity also includes the 135-mile-long Bayou Teche National Water Trail, designated so in 2015 as the 17th water trail in the country and the first in Louisiana (https://www.louisianatravel.com).The mild climate, abundance of natural resources, and unique Spanish and French Acadian heritage provide exceptional recreational opportunities for local, national, and international visitors.

In 1967, the L&WCF approved some of the parks noted in Table 2-6. Section 6(f)(3) of the L&WCF Act assures once an area has been funded with L&WCF assistance, it is continually maintained for public recreation use unless the National Park Service approves substitution property of reasonably equivalent usefulness and location and of at least equal fair market value. The USACE would make an evaluation to determine if any of the project alternatives impact land acquired using L&WCF assistance. Table 2-6 highlights the extensive network of recreation resources within the study area.

Table 2-6. Public Recreation Resources within the Study Area

Public Area	Size (acres)	Parish	Managing Agency	Recreation		Boat Launch	Recreational Highlights
				Consumptive	Non-consumptive		
State Parks							
Cypremort Point State Park	185	St. Mary	Louisiana State Parks	fishing, crabbing	water skiing, windsurfing, sailing, swimming, camping	Yes	This Louisiana State Park site has received assistance from the L&WCF: A half-mile stretch of a man-made beach; a 100-ft fishing pier; 6 cabin rentals, 2 pavilion rentals
Lake Fausse Pointe State Park	6,000	St. Martin, Iberia	Louisiana State Parks	fishing	hiking, camping, boating, canoeing	Yes	8 cabin rentals, 4 pavilion rentals, 17 premium campsites, 33 improved campsites, 5 canoe campsites, 7 backcountry campsites, primitive camping area
Longfellow-Evangeline State Historic Site		St. Martin	Louisiana State Parks	No	hiking, interpretive trails	No	This Louisiana State Park site has received assistance from the L&WCF: tours, group pavilion, museum/historic buildings, outdoor classroom, picnic areas, historic and/or nature programs, hiking trails
Wildlife Management Areas							
Atchafalaya Delta WMA	137,695	St. Mary	LDWF	fishing, hunting, trapping	birding, camping	No	Accessible via boat, 2 campgrounds with primitive restrooms, houseboat mooring
Attakapas Island WMA	27,962	St. Mary, St. Martin, Iberia	LDWF	fishing, crawfishing, hunting, trapping	birding, camping, hiking	No	Accessible via boat, 3 primitive campgrounds, 1 campground with picnic tables, approximately 30 miles of trails
Sherburne WMA	11,780	St. Martin	LDWF	fishing, hunting, trapping	shooting range, camping	Yes	Part of the 44,000 acre Sherburne Complex managed by LDWF, 2 campgrounds- 1 primitive and 1 with running water, ATV trails and all-weather roads
National Wildlife Refuge							
Atchafalaya NWR	15,222	St. Martin and into Iberville	USFWS/ LDWF	fishing, hunting	birding, photography, camping	Yes	Established in 1986 from the L&WCF, Part of the 44,000 acre Sherburne Complex managed by LDWF, restrooms, fishing pier, nature trail, ATV trail, 45,000 visitors annually
Bayou Teche NWR	9,028	St. Mary Parish	USFWS	fishing, hunting	birding, photography, paddling, hiking	Yes	Also referred to as the Louisiana Black Bear NWR, this site has received assistance from the L&WCF, interpretive boardwalk trail, 3 paddling trails, 6,000 visitors annually
State Wildlife Refuge							
Marsh Island NWR	71,000	Iberia	LDWF	fishing, shrimping, crabbing	boating, birding	No	Accessible via boat
City Managed Parks							
Lake Enid Park		St. Mary	Morgan City	fishing	Swimming, camping, hiking birding, marina	Yes	Situated on Lake Palourde, this park offers bank or pier fishing, a boat launch and a marina with 47 slips (monthly and yearly rental rates are available). 147 RV Sites, 20 Tent Sites, and 4 Pavilions are also available

2.9.3.9 Other Social Effects (OSE)

In accordance with the USACE Institute for Water Resources handbook in Applying OSE in Alternatives Analysis (USACE, 2013), the USACE identified seven social factors describing the social fabric of a community. The seven social factors include:

- Physical healthcare and safety
- Regional healthcare
- Employment opportunities
- Community cohesion
- Vulnerable groups
- Recreational activities.

Existing conditions description for each of these resources are provided summarized in the Human Environment description above.

2.9.4 Environmental Justice

Appendix A-2: Environmental Justice provides additional methodology and background material.

Each parish in the study area is majority white. Iberia Parish is the largest with a population of about 73,300, and 39 percent are minority. The majority of the minority population are Black/African American. St. Martin and St. Mary each have a population of approximately 53,000. About 40 percent of Iberia and St. Mary's population is Black, Native American, Asian, Native Hawaiian, Some other Race alone, or Two or More Races (minority). The ACS 2017 total population of the three-parish area is approximately 179,500. Hispanic ethnicity is between 3 and 7 percent of the population. (Table 2-7).

Six federally-recognized Tribes identified the three study area parishes as geographic areas of current and/or ancestral interest:

- Alabama-Coushatta Tribe of Texas
- Chitimacha Tribe of Louisiana
- Coushatta Tribe of Louisiana
- Jena Band of Choctaw Indians
- Mississippi Band of Choctaw Indians
- Tunica-Biloxi Tribe of Louisiana

Of these Tribes, only the Chitimacha Tribe of Louisiana currently holds lands within the study area and exercises sovereignty over that land. The present Chitimacha reservation is located within the northern part of the community of Charenton, in St. Mary Parish, along Bayou Teche (https://www.census.gov/tribal/?st=22&aianihh=0635). The Tribe currently holds 445 acres of land in trust of the Federal Government/Reservation and an additional 500 acres of tribally owned lands. Prior to European settlement of the study area, the Chitimacha occupied about one-third of what is now Louisiana and holds ancestral interests in the entirety of the study area

(http://www.chitimacha.gov). The Native American population is concentrated in Charenton, St. Mary Parish, with a population of 258 or 14.4 percent of the total population of Charenton.

Table 2-7. Census Information

Parish	Total Population	White	Black	Native American	Asian	Native Hawaiian	Some Other Race1	Percent Minority
Iberia	73,346	45,077	23,101	78	2,035	-	3,055	39%
St. Martin	53,609	35,372	15,768	328	537	0	1,604	34%
St. Mary	52,578	31,960	16,362	562	730	7	2,957	39%
Hispanic Population	**Total Population**	**Hispanic**	**% Hispanic**					
Iberia	73,346	2,961	4%					
St. Martin	53,609	1,504	3%					
St. Mary	52,578	3,598	7%					

[1] includes some other race alone and two or more races

Source: U.S. Census Bureau 2013-2017 American Community Survey

While the parishes in the study area, taken as a whole, are majority white, there are minority communities throughout the study area. A review of 21 communities in the study area, (see Appendix A-2: Environmental Justice for community listing), shows six have at least 50 percent or more of the population identifying as non-white. Particularly, Baldwin, Charenton, Franklin, Glencoe, Jeanerette, and St. Martinville each have a majority of the population identifying as a minority. Finally, 16 of the 21 communities have at least 20 percent or more of their population with incomes below poverty.

2.9.5 Cultural and Historic Resources

The consideration of impacts to historic and cultural resources is mandated under Section 101(b)(4) of NEPA as implemented by 40 CFR, Parts 1501-1508 that require Federal agencies to address historic and cultural resources. Section 106 of the NHPA, as amended (54 U.S.C. § 300101 et seq.), and its implementing regulations, set out at 36 CFR Part 800, requires Federal agencies to take into account their effects on historic properties (i.e., historic and cultural resources) and allow the Advisory Council on Historic Preservation an opportunity to comment. Historic properties are identified by qualified agency representatives in consultation with interested parties. USACE has chosen to address potential impacts to historic properties through the "Section 106" process of the NHPA. The Section 106 process lays out four (4) basic steps that must be carried out sequentially: 1) establish the undertakings; 2) identify and evaluate historic properties; 3) assess effects to historic properties; and 4) resolve any adverse effects (avoid, minimize, or mitigate). An agency cannot assess the effects of the undertaking on historic properties until it has identified and evaluated historic properties within the Area of Potential Effects (APE).

The USACE identified historic properties within the study area based on a review of the NRHP database, the Louisiana Division of Archaeology (LDOA) *Louisiana Cultural Resources Map* (LDOA Website), historic maps, pertinent regional and local cultural resources investigations, and other appropriate sources. This review revealed that Iberia Parish has 32 properties and districts listed on the NRHP including one National Historic Landmark (NHL; Shadows-on-the-Teche), as well as the Downtown New Iberia Commercial Historic District and East Main Street Historic District. It is also noteworthy to mention that Avery Island, located in Iberia Parish, was listed in September of 2018 at all three levels of significance (local, state and national) and for all four NRHP criteria (history, association with significant individuals, architecture, and archaeology). St. Martin Parish has a total of 25 properties and districts listed on the NRHP including one NHL (Acadian House) and the Breaux Bridge Historic District and St. Martinville Historic District. St. Mary Parish has a total of 29 NRHP properties and districts listed on the NRHP including Morgan City Historic District, Franklin Historic District, and the Patterson Commercial District. Additionally, approximately 449 archaeological sites have been previously recorded within the current study area that collectively span the entire spectrum of Pre-Contact and Post-Contact archaeological components known within the region; encompassing some 10,000 years or more. It is also important to stress that many of the known sites in the study area have occupation spans encompassing more than one of these cultural/temporal periods attesting to the long-ranging cultural importance of the region.

2.9.6 Land Use

The 2011 National Land Cover Database (NLCD) Data includes the most up-to-date data concerning the study area. Table 2-8 depict the study area's various land uses.

According to the NLCD database, the study area had a slight increase in developed impervious surfaces between 2006 and 2011. This is noteworthy as increases in impervious surfaces can lead to lower water quality, higher nutrient loads, and increased stormwater runoff. Still, 96 percent of soils overall, had a loss of less than 1 percent of impervious soils in the study area. In the affected area outside the study area, there were increases in impervious soils, but at a slower rate.

Table 2-8. Land Cover

Land Cover	Acreage
Barren Land	8,549
Cultivated Crops	241,321
Deciduous Forest	4,620
Developed, High Intensity	3,318
Developed, Low Intensity	45,336
Developed, Medium Intensity	4,415
Developed, Open Space	26,780
Emergent Herbaceous Wetlands	252,894
Evergreen Forest	349
Hay/Pasture	44,509
Herbaceous	3,996
Mixed Forest	1,3109
Open Water*	136,620
Shrub/Scrub	3,400
Woody Wetlands	595,191

* Open Water does not include Gulf of Mexico water acreage.

Cities, Towns, and Villages

Table 2-9 lists the study area's major cities, towns, and villages.

Table 2-9. Study Area Overview

Parish	Total Area (mi^2)	Land Area (mi^2)	Water Area (mi^2)	Industry	Cities, Towns and Villages	State & Federal Natural Areas
St. Martin	816	744	72	Agriculture Fishing Tourism	Henderson Arnaudville Breaux Bridge Broussard St. Martinville	Atchafalaya NWR Attakapas State WMA
Iberia	1,031	574	457	Oil and Gas Shipping Agriculture Fishing	Jeanerette New Iberia Delcambre Loreauville	Shell Keys NWR Attakapas State WMA
St Mary	1,119	555	564	Oil and Gas Agriculture Tourism Fishing	Franklin Morgan City Patterson	Bayou Teche NWR Attakapas State WMA Cypremont Point State Park

From the US Census Quick Facts, https://www.census.gov/quickfacts/fact/table/

Land Use and Emergency Operations Plans

Master plans, in general, present an inventory of land resources, land classifications, development plans, emergency operations, and many other planning opportunities. Depending on the master plan, they provide management concepts for environmental stewardship of environmentally sensitive areas and other lands, existing and expanded facilities, and connections between people and nature. Other master plans may map out future urban growth or transportation ideas aimed at meeting future car, truck, and public vehicle use.

Each USACE alternative must consider how planning by the USACE, Federal, Tribal, state, or local agencies and private entities would be affected by the proposed action(s). The proposed action must be consistent with the master plans. The three parishes each have emergency management plans. These plans aim to reduce the loss of life, suffering, and property damage resulting from emergencies or disasters. All Federal and state regulations, authorities, and other directives are taken into account when creating an emergency operations plan (EOP). An EOP is intended to be broad enough to cover any disaster while also maintaining specific instructions for each individual disaster

possibility. Appendix A-1: Environmental Resources, documents the known EOP for each parish in the study area.

2.9.7 Aesthetics and Visual Resources

Aesthetics and visual resources are institutionally important because of the laws and policies affecting visual resources, most notably NEPA and the USACE ER 1105-2-100. Visual resources are technically important because of the high value placed on the preservation of unique geological, botanical, and cultural features. Aesthetic resources are publicly important since environmental organizations and the public support the preservation of natural pleasing vistas.

The entire affected area is within the Atchafalaya National Heritage Area. Heritage areas are regions with concentrations of significant natural, scenic, cultural, historic, and recreational resources. (Louisiana Department of Culture, Recreation & Tourism, 2010). The Atchafalaya National Heritage Area has unique attributes as both a place and a cultural icon.

The Atchafalaya Basin Floodway System, situated within the Atchafalaya National Heritage Area, contains one of the largest BLH forest swamps in North America. It also has significant cultural, historic, scenic and recreational resources. Atchafalaya Basin Floodway System holds magnificent wilderness; home to abundant wildlife, endangered species and critical black bear habitat, and superb recreational and commercial fishing, trapping, and hunting opportunities. The areas within the Atchafalaya Basin Floodway System give the viewer near unobstructed views of an aesthetically pleasing landscape. Approximately 400,000 acres of Louisiana's Atchafalaya Basin are publicly-owned lands. These public lands help ensure the unique natural resources offered in the basin are protected for future generations to experience. The Bayou Teche Byway is a 184-mile long Louisiana Scenic Byway though rural landscapes and culturally significant Cajun communities. Dense patches of oaks and other native BLHs, draped with Spanish moss, line the banks of the bayou. The landscape here is pastoral and serene, adding to the visual quality of the area. Bayou Teche and its relationship with man can be traced back to the native Chitimacha Tribe. Their legend of the bayou's origin is of an enormous snake that, when killed by Chitimacha warriors, broadened, curved, and deepened the place where its enormous body lay (http://chitimacha.gov). The surrounding habitat is composed of a broad mixture of open fields fronting the major thoroughfares of the region, surrounded by a backdrop of deep-wooded inland swamps. The scenery has remained mostly rural and natural along state and local corridors. Along Hwy 90/future I-49 corridor, the scenery changes to more developed, with commercial and industrial development surrounding local townships.

Brackish and saline marshes dominate the Deltaic Coastal Marshes and Barrier Islands ecoregion south of the GIWW. Based on available aerial photography, the visual conditions have changed significantly over the past 20 years due to the growth of urban development and the loss or conversion of swamps into marsh, or open water areas. Prevalent within the affected area is undeveloped land occasionally broken up by maritime-related industry and private fishing camps and boat moorings. Unnatural

straight channels and related spoil banks cut through the coastal marsh, contrast the natural landscape combination of marsh and meandering waterways. Navigation for petroleum, fisheries, or other related resources most likely caused this development.

2.9.8 Water Quality and Salinity

In general, poor water quality concerns in the affected area are a result of oil and gas activities, saltwater intrusion, and agriculture-related activities. Shoreline configurations and elevations, surface water budgets, land cover and use, and regional weather also influence water quality. The affected area consists of low relief topography to the north and an estuary in the south. Water salinity increases in the south of the affected area near estuary habitats. The area includes the Vermilion, Bayou Teche, and Atchafalaya River Basins.

The Louisiana Department of Environmental Quality (LDEQ) strives to meet Clean Water Act (CWA) requirements. Section 303(d) of the CWA requires each state to identify water quality impaired waters. The state must then develop a total maximum daily loads (TMDL) describing a plan for restoring the impaired water(s). The TMDL identifies the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards. The LDEQ may add additional water quality parameters for each identified stream segment such as:

- Technology-based effluent limitations required by sections 301(b), 306, 307 or other sections of the Act;
- More stringent effluent limitations (including prohibitions) required by either state or local authority preserved by § 510 of the Act or federal authority (law, regulation, or treaty); and
- Other pollution control requirements (e.g., best management practices) required by local, state, or federal authority are not stringent enough to implement any water quality standards applicable to such waters.

The 2018 Water Quality Inventory Report (LDEQ, 2018) indicated 50 percent of the 12 water body subsegments within the Atchafalaya Basin were fully supporting their three primary designated uses of primary contact recreation, secondary contact recreation use, and fish and wildlife propagation. However, 50 percent of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include fecal coliform, suspended solids, sedimentation/siltation, mercury, turbidity, and low concentration of dissolved oxygen. The suspected sources of the water quality problems include crop production, petroleum activities, channelization, dredging, industrial point sources, waste storage, tank leaks, and spills (LDEQ, 2004).

The area has experienced hydro-modification via the construction of water control structures, canals, and embankments. Chemical transformations occurring in the estuary can be biologically mediated by estuary wetlands (Mitsch and Gosselink, 2000). A diversity of wetland types exist within the affected area, affected both negatively and positively by geomorphology and anthropogenic factors. Weather patterns can affect marine influence, flow direction, water level, and wetlands biogeochemistry (Gosselink,

1984). Timing and amount of precipitation can also affect water quality (Demcheck et al., 2004).

Tidal surges from Hurricanes Katrina, Rita, Gustav, and Ike deposited enormous amounts of salt in the sugarcane fields of coastal Louisiana in a period of active tropical weather from 2005 to 2008, resulting in soil salinity levels ranging from 268 to 4,329 parts per million. High levels are attributed to proximity to salty water subject to tidal movement and a high water table. While storm surge has an impact to crops such as sugarcane, for more than 200 years the sugarcane industry has survived the aftermath of countless tropical storms primarily because Louisiana's high rainfall serves to mitigate the damage to sugarcane caused by soil salinity (Viator et al., 2011).

Invasive species, such as hydrilla, giant salvia, and water hyacinth show rapid growth and, in some cases, higher tolerance to salinity. Those species have a huge negative economic impact on a range of activities including farming, fishing, and recreational sports. Invasive species choke native plant species, stunt fish population, crowd out waterfowl, reduce water volume, make the water reservoirs impenetrable to boats, and hurt recreational as well as commercial fishing.

Wind, rain, tides, and freshwater influx from streams and diversions are variables causing salinity fluctuation and play a vital role in the health of the basin's estuaries.

2.9.9 Aquatic Resources

The affected area has a wide variety of wetlands, estuaries, lakes, streams, and rivers. This section briefly discusses the affected area's dominant aquatic resources.

Gulf Coastal Shorelines

Between 1932 and 2016, while other basins in Louisiana were losing land, the Atchafalaya Basin gained over 6 square miles (4,000 acres) of wetlands, as shown in Table 2-10. The Atchafalaya River is the last major tributary of the Mississippi River. Atchafalaya receives, on average, 30 percent of the combined flow of the Mississippi and Red Rivers, or around 300,000 cubic feet of water per second. The Coastal Protection and Restoration Authority's 2017 Masterplan interactive website (http://cims.coastal.louisiana.gov/masterplan/) graphically displays coastal wetland loss projected for the next 50 years.

In 1942, the USACE dredged a channel from the Atchafalaya River to the Gulf of Mexico to decrease water levels moving past Morgan City, splitting the flow of water and sediment between the Atchafalaya River and the Wax Lake Outlet. Over time, sediment filled in the Wax Lake, and the Wax Lake Delta emerged. The Atchafalaya River delta has also grown with an increase of sediment settling out at the river reaches the Gulf of Mexico. This new land pushing out into the Gulf has continued over the years, despite challenges affecting many areas of Louisiana's coast including land subsidence, sea level rise, and hurricanes. The land built and sustained by the Wax Lake Outlet is swamp and marsh habitat that is teeming with life, and the Wax Lake Delta is a picture of a living, thriving delta.

However, in most areas along the Louisiana coast, shorelines are vanishing at an alarming rate. Shorelines on either side of the Atchafalaya Basin are being lost (Figure A1:1-6 Appendix A-1:Environmental Resources). Since the 1930s, about 2,000 square miles of land have turned into open water – an area nearly the size of the state of Delaware. Between 1932 and 2016, the Terrebonne Basin lost more than 500 square miles (30,000 acres) of wetlands. This basin is the remnants of an old delta complex formed when the main flow of the Mississippi River drained into this area 500-2,500 years ago.

Gulf coastal shorelines, located along the northern rim of the Gulf of Mexico, provide essential and critical shelter, nesting, feeding, roosting, cover, nursery, and other habitats and life requirements for fish and wildlife. They function as the boundary between marine and estuarine ecosystems and provide protection to the estuarine wetlands, bays, and other inland habitats. Coastal shorelines, as well as other coastal landscape features, such as shoals, coastal marshes, and forested wetlands, can provide a significant and potentially sustainable buffer from wind wave action and storm surge generated by tropical storms and hurricanes. Rapid deterioration of the barrier coast is resulting in a transformation of low-energy, semi-protected bays into high-energy, open marine environments (Stone et al., 2005).

Lakes and Rivers

The affected area has two primary subbasins (see Appendix A-1:Environmental Resources for additional subbasin information).

The Vermilion subbasin is located west of Bayou Teche and drains in a general southerly direction towards Vermilion Bay and West Cote Blanche Bay. The Vermilion subbasin contains the GIWW, traversing Iberia Parish both inland of and along the shore of Vermilion Bay. In addition, other water bodies include Lake Peigneur on the border with Vermilion Parish, Spanish Lake on the border with St. Martin Parish, Bayou Petite Anse, Bayou Carlin, Bayou Patout, and many other streams and canals.

The Bayou Teche subbasin is present in the central part of the parish and extends from near the western bank of Bayou Teche eastward to include Lake Fausse Pointe. Lake Fausse Pointe, located in Iberia and St. Mary Parishes, is a large, shallow lake separated from the Atchafalaya River Floodway by a levee. At an average estimated water-surface elevation of about 2 feet above National Geodetic Vertical Datum (NGVD) 29, the lake has a surface area of about 24 square miles and an average depth of about 3 feet (Shampine, 1971). Lake Paluorde lies just northeast of Morgan City. This lake is approximately 11,000 acres of shallow, marshy edges.

Table 2-10. Predicted Acreage Loss of Different Wetland Types in Study Area

Region	Fresh Marsh Acres in 1990	Intermediate Marsh Acres in 1990	Brackish Marsh Acres in 1990	Saline Marsh Acres in 1990	Total Marsh Acres in 1990	Swamp Acres in 1990	Fresh Marsh Lost by 2050	Intermediate Marsh Lost by 2050
N. Wax Lake Wetlands	2,770	0	0	0	2,770	2,340	460	0
Wax Lake Wetlands	43,61	0	0	0	43,610	10,255	5,860	0
Atchafalaya Bay Delta	2430	0	0	0	2430	0	Gain 44.430	0
Atchafalaya Total	48,810	0	0	0	48,810	12,595	Gain 38,110	0
TECHE/VERMILION BASIN								
Cote Blanche Wetlands	43,470	2,690	0	0	46,160	12,430	510	250
Vermilion Bay Marsh	6,610	29,970	36,660	0	73,240	5,960	0	3,950
Marsh Island	0	0	49,390	7,080	56,470	0	0	0
Rainey Marsh	245	7,770	47,990	2,410	58,415	0	0	780
Teche/Vermilion	50,325	40,430	134,040	9,490	234,285	18,390	510	4,980
Region 3 Total	298,330	92,680	240,750	140,155	771,915	183,384	5,975	23,590

Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority, 1999

Coastal Zone Federal Consistency

The Coastal Zone Management Act of 1972, Section 307 (CZMA), called the "Federal consistency" provision, gives states a strong voice in Federal agency decision making, which they otherwise would not have, for activities affecting a state's coastal uses or resources. The Federal consistency provision is a major incentive for states to join the National Coastal Zone Management Program and is a powerful tool that state programs use to manage coastal activities and resources and to facilitate cooperation and coordination with Federal agencies.

The OCM of the LDNR is charged with implementing the Louisiana Coastal Resources Program (LCRP). The OCM regulates development activities and manages the resources of the coastal zone, especially those that have a direct and significant impact on coastal waters.

Appendix A-7:Coastal Zone Consistency, has a map showing the coastal zone in Iberia, St. Martin, and St. Mary Parishes and includes the USACE's preliminary coastal zone consistency determination and relevant coordination. These documents include more detailed discussion of baseline coastal zone conditions.

Vegetation and Estuary Resources

The affected area consists of open water ponds and lakes, gulf shorelines, and freshwater, intermediate, brackish, and saline marsh (Table 2-11) (additional maps are in Appendix A-1: Environmental Resources). These aquatic areas contain a wide variety of vegetation.

Mississippi Alluvial Plain vegetation includes:

- Cypress and tupelo-gum found in low-lying areas typically adjacent to waterways, dominate swamp habitats.
- Riverine habitats along stream and river bottoms and bottomland forests are comprised of water tupelo, willow, sycamore, cottonwoods, green ash, pecan, elm, cherrybark oak, and white oak; these are often interspersed with Chinese tallow. Depending upon the locations, riverine habitats grade into higher elevated and better drained areas comprised of oak-pine forests.
- Oak-pine forest types dominate the better drained areas especially surrounding Lake Charles and Sulfur and include longleaf pine, loblolly pine, slash pine, sweetgum, elm, southern red oak, water oak, black gum, and Chinese tallow.
- Pasture and rangelands with mixtures of perennial grasses and legumes (e.g., Bermuda grass, Pensacola Bahia grass, tall fescue, and white clover) comprise the majority of the outlying areas surrounding Abbeville, Erath, and Delcambre.

Mississippi Alluvial Plain consists of back barrier vegetated areas; freshwater, intermediate, brackish, and saline marsh; interspersed with bayous, lakes, ponds and

other waters may have submerged aquatic vegetation (SAVs). Vegetation typically follows the salinity gradient (O'Neil 1949; Chabreck et al. 1972; Gosselink et al. 1979; Visser et al. 2000). Specifically:

- Gulf shoreline vegetation includes sea-beach orach, sea rocket, pigweed, beach tea, salt grass, seaside heliotrope, common and sea purslane, marsh-hay cordgrass, and coastal dropseed (LCA, 2004, Gosselink et al., 1979).
- Marsh types: Visser et al. (2000), expanding on previous studies by Penfound and Hathaway (1938) and Chabreck (1970), classified freshwater marsh in the Chenier Plain as a combination of maidencane and bulltongue arrowhead; intermediate marsh as sawgrass, saltmeadow cordgrass, and California bulrush; brackish marsh as saltmeadow cordgrass, chairmaker's bulrush, and sturdy bulrush; and saline marsh as smooth cordgrass, needlegrass rush, and saltgrass.
- SAV: wild celery, duckweed, pickerelweed, sago pondweed, and southern naiad.

Invasive Plants

Invasive plants found within the affected area include water hyacinth, alligatorweed, hydrilla, common salvinia, giant salvinia, Chinese tallow, Chinese privet, Cogon grass, Johnsongrass, Japanese privet, Japanese honeysuckle, common ragweed, rescuegrass, sticky Chickweek, purple nutsedge, and mimosa tree. These invasive species compete with native flora for resources such as nutrients and light, community structure and composition, and ecosystem processes. Water hyacinth, common salvinia, giant salvinia, and hydrilla all limit the amount of light penetrating the water column affecting plankton biomass production. Alligatorweed, Chinese tallow and Chinese privet are of minimal wildlife value and can proliferate until nearly monocultural stands exist, limiting food available for wildlife.

Rare, Unique, and Imperiled Vegetative Communities

The Louisiana Natural Heritage Program (LNHP) documented the following rare, unique, and imperiled communities. Vegetation communities contribute to the diversity and stability of the coastal ecosystem. Table 2-11 displays information from the LNHP database identifying rare, unique or imperiled vegetative communities within the study area. See Appendix A-1:Environmental Resources for detailed information concerning important vegetative community resources within the study area.

Table 2-11. Louisiana Natural Heritage Program Rare, Unique, or Imperiled Vegetative Communities within the Study Area

Vegetative Communities	Basins or Parish
Coastal Live Oak-Hackberry Forest	Iberia
Cypress Swamp	Iberia, St. Mary
Cypress-Tupelo Swamp	Iberia, St. Martin, St. Mary
Salt Dome Hardwood Forest	Iberia, St. Mary
Freshwater Marsh	St. Mary
Hardwood Slope Forest	St. Mary
Live Oak Natural Levee Forest	St. Mary
Vegetated Pioneer Emerging Delta	St. Mary

(http://www.wlf.louisiana.gov/wildlife/species-parish-list?tid=228&type_1=fact_sheet_community) December 2, 2018

2.9.10 Fish and Wildlife Resources

Fisheries Resources

The affected area contains a variety of aquatic habitats, including rivers, bayous, canals, lakes, ponds, shallow open water areas, the Gulf of Mexico, and estuarine marsh and embayments. Salinity and habitat structure (SAV, marsh, tidal creeks, deep water, oyster reefs, and benthic substrate) are the primary drivers affecting the distribution of fish and macrocrustaceans throughout the area. There are three general types of aquatic animals: freshwater resident, estuarine resident, and transient marine species. Gosselink et al. (1979) provides an extensive overview of benthic resources in the area. The bottom estuarine substrate or benthic zone regulates or modifies most physical, chemical, geological, and biological processes throughout the entire estuarine system via benthic effect (Day et al. 1989).

Gulf of Mexico near-shore benthic habitats are more thoroughly studied and for longer periods, resulting in a greater understanding of status and trends. Within the Gulf of Mexico, four benthic habitats have protracted temporal and synoptic data: oyster reefs, seagrasses, mangroves, and coastal wetlands (NOAA, 2013). Mangroves are in southeastern Louisiana and not located within the study area. Gosselink et al., (1979) describes the coastal wetland benthic community in the affected area.

Oysters and mussels from the epibenthic community provide commercial and recreational fisheries throughout the gulf and the affected area (Appendix A-1:Environmental Resources, LDWF, 2018). They also create oyster reef habitats used by many marine and estuarine organisms.

Salinity and submerged vegetation affect the distribution of fish and macrocrustaceans throughout the area with three general types: freshwater, resident, and transient marine species. Some freshwater species may tolerate low salinities, generally live in the

freshwater portions of the more interior and northern-most regions of the area. Resident species are generally smaller and do not commonly migrate very far. Marine transient species spend a portion of their life cycle in the estuary, generally spawning offshore or in high-salinity bays, and use coastal marshes as nursery areas (Herke 1971, 1995). Based on current habitat loss trends, fish populations in the area should be reduced as well.

Wildlife Resources

Coastal and especially estuarine wildlife is taxonomically diverse with distributions shaped by landforms, climate, salinity, tides, vegetation, other animals, and human activities (Day et al. 1989). Area estuarine wetlands and barrier habitats have historically provided many different species of birds and other wildlife with shelter, nesting, feeding, roosting, cover, nursery, and other life requirements. These habitats provide neotropical migrants with essential staging and stopover habitat (Stoffer and Zoller 2004). Coastal wetlands attract thousands of trans-gulf migrant birds during their peak migratory months of April to May and August through October. The majority of these birds fly to and from parts of Mexico, and the wetlands offer the birds an important stop-over on their migration. Millions of ducks and geese use the area from September through February. Over 300 species of birds have been recorded in the area, making this region a popular destination for visiting birders, wildlife photographers, and hunters. However, climate and seasonal availability of resources affect birds and other wildlife use of estuaries. (Day et al. 1989). Vegetated habitats within urban and suburban areas, such as BLH and swamp habitats along streams, lakes, and other waterways, provide critical breeding bird habitats (Wakeley and Roberts 1996).

Migratory Birds

Among the several sources documenting Louisiana birds, Lowery (1974) indicates the area supports shorebirds (e.g., piping plover, sandpipers, gulls, stilts, skimmers, and oystercatchers); ducks and geese (e.g., mottled duck, mallard, fulvous tree-duck, pintail, teal, wood duck, scaup, mergansers, and Canada goose); herons, egrets, ibis, and cormorants; hawks and owls (e.g., bald eagle, osprey, and barred owl); belted kingfisher; woodpeckers and sapsuckers; marsh birds (e.g., rails and gallinules); and various songbirds (e.g., wrens, flycatchers, swallows, warblers, and vireos). Waterfowl, seabirds, coots, and rail populations are stable within the region.

In Louisiana, the primary nesting period for forest-breeding migratory birds occurs between April 15 and August 1. Some species or individuals may begin nesting prior to April 15 or complete their nesting cycle after August 1, but the vast majority nest during this period.

Colonial nesting waterbird rookeries (e.g., herons, egrets, ibis, night herons, and roseate spoonbills) are found throughout and generally show stable or increasing populations. Habitat loss and fragmentation is among the most pervasive threats to the conservation of biological diversity (Rosenberg et al., 1997). The study area's BLH,

swamp, and other riverine habitats provide travel corridors for birds and other wildlife connecting populations that have been effected by habitat loss and fragmentation.

Bald Eagles

The proposed study area may provide nesting habitat for the bald eagle (*Haliaeetus leucocephalus*). The bald eagle was officially removed from the List of Endangered and Threatened Species as of August 8, 2007. However, the bald eagle remains protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The LDWF has not collected comprehensive bald eagle survey data since 2008, and new active, inactive, or alternate nests may have been constructed within the study area since that time.

Bald eagles typically nest in large trees located near coastlines, rivers, or lakes supporting adequate foraging from October through mid-May. In southeastern Louisiana parishes, eagles typically nest in mature trees (e.g., baldcypress, sycamore, willow, etc.) near fresh to intermediate marshes or open water. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants. Furthermore, bald eagles are vulnerable to disturbance during courtship, nest building, egg laying, incubation, and brooding. Disturbance during these periods may lead to nest abandonment, cracked and chilled eggs, and exposure of small young to the elements. Human activity near a nest late in the nesting cycle may also cause flightless birds to jump from the nest tree, thus reducing their chance of survival. Eagles are becoming more tolerant to human activity and are expanding their populations.

Mammals

Most estuarine mammals show distributions or behaviors related to salinity patterns (Day et al. 1989). Large herbivores and carnivores include manatee, coyote, red wolf, ringtail, and river otter; smaller herbivores include swamp rabbit, fulvous harvest mouse, eastern wood rat, and nutria. Populations of furbearers (nutria, muskrat, mink, otter, and raccoon) and game mammals (rabbits, squirrels, and white-tailed deer) have been stable or increasing within the study area and should continue into the future. Prior to the introduction of nutria to Louisiana in 1930s, no invasive wildlife species were present. A substantial population increase of nutria is attributed to declines in the price of pelts (Baroch et al., 2002).

Amphibians and Reptiles

Common species of amphibians and reptiles include the gulf coast salt marsh snake, gulf coast toad, pig frog, American alligator, diamondback terrapin, Mediterranean gecko, Texas horned lizard, red-eared slider; and snakes (e.g., plain-bellied water snake, banded water snake). Various lizards, and skinks are found within the study area (LDNR, 2018). Amphibian and reptile population data is limited, with the exception of the American alligator whose population continues to remain stable (LDWF, 2018). Amphibian and reptile populations should follow current population trends.

2.9.11 Threatened/Endangered Species and Other Protected Species of Concern

The USACE initiated discussions with USFWS and the NMFS at a resource meeting on November 6, 2018. Subsequently, the USFWS provided a Fish and Wildlife Coordination Act planning aid letter (PAL) dated November 20, 2018 (Appendix A-6: Fish and Wildlife Coordination Act). In the PAL, the USFWS identified federally T&E species.

There are ten T&E and four at risk species known or believed to occur in the area (Table 2-12). There are no T&E plants. Detailed descriptions of critical habitats and T&E species are in Appendix A-4: Endangered Species Act Coordination. The USACE solicited the LDWF's Natural Heritage Database for state-listed species as well (Table 2-12).

Table 2-12. Federally- and State-listed Threatened and Endangered Species in the South Central Coast, LA Study Area

Animal	Species	Scientific Name	Status*		Parish
			State	Federal	
Birds	Snowy plover	*Charadrius alexandrinus*	Critically imperald		St. Mary
	Piping plover	*Charadrius melodus*	T/E	T	St. Mary
	Gull-billed Tern	*Gelochelidon nilotica*	imperald		Iberia, St. Mary
	Bald Eagle	*Haliaeetus leucocephalus*	E	Delisted but federally protected	Iberia, St. Mary, St. Martin
	Roseate Spoonbill	*Platalea ajaja*	Rare and local		Iberia, St. Mary, St. Martin
	American Swallow-tailed Kite	*Elanoides forficatus*	Critically imperald		St. Martin
	Common Ground-Dove	*Gelochelidon nilotica*	Critically imperald		Iberia
	Osprey	*Pandion haliaetus*	imperald		St. Martin
	Golden-Winged Warbler	*Vermivora cyanoptera*		AR	
	Red Knot	*Calidris canutus rufa*		T	Iberia, St. Mary
	Eastern Black Rail	*Laterallus jamaicensis*	T	T	Iberia, St. Mary, St. Martin
Fish	Paddlefish	*Polyodon spathula*	Rare and local		St. Mary, St. Martin
	Pallid Sturgeon	*Scaphirhynchus albus*	E	E	Iberia, St. Mary, St. Martin
Mammals	Louisiana Black Bear	*Ursus americanus luteolus*	T	Delisted but federally protected	St. Mary, St. Martin
	Eastern Harvest Mouse	*Reithrodontomys humulis*	Rare and local		St. Martin
	West Indian Manatee	*Trichechus manatus*		T	Iberia, St. Mary, St. Martin
Crustacean	Old Prairie Crawfish	*Fallicambarus macneesei*	imperald		St. Martin
Reptiles	Alligator Snapping Turtle	*Macrochelys temminckii*	Restricted Harvest	AR	Iberia
	Green Sea Turtle	*Chelonia mydas*		E	Iberia, St. Mary, St. Martin
	Hawksbill Sea Turtle	*Eretmochelys imbricata*		E	Iberia, St. Mary, St. Martin
	Kemp's Ridley Sea Turtle	*Lepidochelys kempii)*		E	Iberia, St. Mary, St. Martin
	Leatherback Sea Turtle	*Dermochelys coriacea*		T	Iberia, St. Mary, St. Martin
	Loggerhead Sea Turtle	*Caretta caretta*		E	Iberia, St. Mary, St. Martin
Insect	Monarch Butterfly	*Danaus plexippus plexippus*		AR	Iberia, St. Mary, St. Martin

http://www.wlf.louisiana.gov/wildlife/species-parish-list?tid=228&type_1=fact_sheet_animal Dec 2, 2018, and the DRAFT USFWS Planning Aid Letter, dated Nov 20, 2018 (Appendix A6
E-Endangered = Taking or harassment of these species is a violation of state and Federal laws. **T**-Threatened = Taking or harassment of these species is a violation of state and Federal laws. **T/E**-Threatened/Endangered = Taking or harassment of these species is a violation of state and Federal laws.
Prohibited = Possession of these species is proh bited. No legal harvest or possession. **Restricted Harvest** = There are restrictions regarding the taking and possession of these species.
AR-At Risk = Proposed for listing under the ESA by the Service; 2). Candidates for listing under the ESA, meaning the species has a "warranted but precluded 12-month finding"; or 3) Petitioned for listing under the ESA, meaning a citizen or group has requested the Service add them to the list of protected species.

2.9.12 Air Quality

Air pollution comes from many different sources: stationary sources such as factories, power plants, and smelters and smaller sources such as dry cleaners and degreasing operations; mobile sources such as cars, buses, planes, trucks, and trains; and naturally occurring sources such as windblown dust, all contribute to air pollution. Air Quality can be affected in many ways by the pollution emitted from these sources. These pollution sources can also emit a wide variety of pollutants.

The Clean Air Act requires the USEPA to establish National Ambient Air Quality Standards (NAAQS) for six criteria pollutants considered harmful to public health and the environment (USEPA, 2016a). There are two types of standards, primary and secondary. Primary standards protect against adverse health effects; secondary standards protect against welfare effects, such as damage to farm crops and vegetation and damage to buildings. The six criteria pollutants addressed in the NAAQS are carbon monoxide, nitrogen dioxide, lead, ozone (or smog), particulate matter, and sulfur dioxide. These pollutants are monitored by the USEPA, as well as national, state and local organizations. If the levels of these pollutants are higher than what is considered acceptable by USEPA, then the area in which the level is too high is called a nonattainment area.

There are no nonattainment areas within the study area for any measured pollutant (USEPA, https://www.epa.gov/green-book, December 2019).

2.9.13 Noise

The Noise Control Act of 1972 (P.L. 92-574) directs federal agencies to comply with applicable federal, state, interstate and local noise control regulations. In 1974, USEPA provided information suggesting that continuous and long-term noise levels in excess of day-night sound level 65 A-weighted decibels (dBA) are normally unacceptable for noise-sensitive land uses such as residences, schools, churches, and hospitals. Each parish in the study area has ordinances dealing with noise (https://library.municode.com/la). These range from ambient noise in different residential and commercial zones to noise control for animals and birds.

Ambient noise levels within the study area are influenced by land uses, including industrial, commercial, residential and agricultural areas. Noise sources include primarily vehicular traffic, trains, and large transport vehicles travelling in the study area. Secondary noise sources include industrial activities and construction along parish and township roads.

2.9.14 Hazardous, Toxic, and Radioactive Waste

HTRW includes any material listed as a “hazardous substance” under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 et seq. [See 42 U.S.C. 9601(14)]. Hazardous substances regulated under CERCLA include "hazardous wastes" under Sec. 3001 of the Resource Conservation and Recovery Act, 42 U.S.C. 6921 et seq (Resource Conservation

Recovery Act (RCRA)); "hazardous substances" identified under Section 311 of the CWA, 33 U.S.C. 1321, "toxic pollutants" designated under Section 307 of the CWA, 33 U.S.C. 1317, "hazardous air pollutants" designated under Section 112 of the Clean Air Act, 42 U.S.C. 7412; and "imminently hazardous chemical substances or mixtures" the EPA has taken action under Section 7 of the Toxic Substance Control Act, 15 U.S.C. 2606; these do not include petroleum or natural gas unless already included in the above categories.

The USACE used the EPA's Envirofacts website mapper to identify 9,855 EPA-regulated facilities within or in close proximity to the study area (EPA, 2018).

Known facilities include:

- stationary sources of air pollution (such as electric power plants, steel mills, factories, and universities) regulated by EPA, state and local air pollution agencies (Clean Air Act),
- clean-up projects at the worst known hazardous waste sites (CERCLA),
- large direct emissions sources and suppliers of certain fossil fuels and industrial gases and greenhouse gas (GHG) (Consolidated Appropriations Act (H.R. 2764; Public Law 110--161)),
- companies issued permits to discharge wastewater into rivers (CWA),
- Facilities that are regulated by USEPA regulations for radiation and radioactivity 40 CFR Parts 191 and 194; 40 CFR Part 61; and 40 CFR Part 300.
- hazardous waste handlers, (RCRA)
- Facilities that manufacture, process, or otherwise use these chemicals in amounts above established levels must report how each chemical is managed through recycling, energy recovery, treatment, and releases to the environment (Toxic Substances Control Act of 1976), and
- Facilities engaging in production, importation, use, and disposal of specific chemicals including polychlorinated biphenyls, asbestos, radon and lead-based paint (Toxic Substances Control Act of 1976).

Given the level of ongoing development in the region, it is difficult to accurately identify all of the potential hazardous materials existing within or adjacent to the study area. Federal law requires site-specific due diligence on a case-by-case basis before development can take place.

2.9.15 Soils

Sedimentation and Erosion

Rivers and waterways in the study area influence the movement of sediment throughout the area. The rivers and interior lakes they enter (Lake Peigneur, Lake Fausse Pointe,

Flat Lake, Grand Lake, Yellow Bayou, and Spanish Lake) act as sediment sinks. Overbank deposition into adjacent marshes is minimal in these low flow rivers. Sediments in the interior lakes can be re-suspended and deposited in adjacent marshes during storm events and cold front passages. Extensive hydrologic alterations within the area (levees, channels, roads, locks, control structures, etc.) influence sediment movement throughout. Sediments in the rivers making it to the coast are deposited at the mouths and generally move westward nourishing the beaches and marshes.

A significant source of sediment is the Atchafalaya River (McBride et al., 2007). Sediment travels to the Atchafalaya Bay and spreads throughout the bay area through tidal exchange at the gulf and from flooding during storm events. A large percentage of Atchafalaya River sediments are deposited along the gulf shoreline near FWB as mudflats while coarser sediments continue westward along the shoreline.

The Louisiana coast has approximately 350 miles of sandy shoreline along its barrier islands and gulf beaches; however, there are about 30,000 miles of land-water interface along bays, lakes, canals, and streams. Most of these shores consist of muddy shorelines and bank lines, and virtually all are eroding. In many instances, rims of firmer soil around lakes and bays, and natural levees along streams have eroded away leaving highly organic marsh soils directly exposed to open water wave action. High rates of gGulf shoreline erosion occur from the vicinity of Rollover Bayou, west to the Mermentau River. Accelerated shoreline loss occurs where erosion has caused gulf, lake, and channel shorelines to intersect interior water bodies.

During storms, suspended sediments enter buildings and warehouses through non-watertight an damaged openings, such as person doors, windows and garage doors. Some of the sediments are deposited in the structure and remain after the water recedes. Typical storm clean up in the project area, especially by commercial facilities, requires sediment and debris removal and sanitary waste management. Businesses follow best practices in accordance with the USEPA and LDEQ requirements (Comprehensive Plan for Disaster Clean-up and Debris Management (LADEQ, 2021 https://deq.louisiana.gov/assets/docs/Solid-Waste/DebrisManagementPlanrevised093021.pdf).

Storm suspended sediment poses a greater water quality risk than just soil particles alone, because it often carries other pollutants, such as nutrients, heavy metals, organic chemicals, bacteria and other pathogens along with it. These pollutants originate from sources such as agriculture, industrial waste, mine spoils, and urban contaminants and can have short-term and long-term effects. Some will be dissolved into the water and wash away quickly, while others may remain stuck to sediment for years.

Prime and Unique Farmlands

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

About 118,654 acres in St Mary Parish, or nearly 27 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are mainly in the northwestern and central parts of the parish. All areas of this prime farmland are used for crops. The crops grown on this land, mainly bahiagrass, common bermudagrass, cotton lint, rice, soybeans, sugarcane, tall fescue, improved bermudagrass, corn, wheat, sweet potatoes, and grain sorghum account for a majority of the parish's total agricultural income each year.

The USACE found limited and dated prime and unique soil information for Iberia and St Martin Parishes. Iberia Parish has 376,960 acres of land with 144,748 acres of prime farmland (38.3 percent). St. Martin Parish has 471,040 acres of land with 240,054 acres of prime land (50.9 percent) (Ramsey, 1981).

A recent trend of increased industrial and urban land use in some parts of the study area resulted in the loss of some prime farmland. The loss of prime farmland to other uses puts pressure on marginal lands generally more erodible, droughty, and less productive and cannot be easily cultivated.

The majority of the gulf coast marshes consists of wetland type soils, and shorelines are prone to frequent flooding and are not suitable for agricultural use. Prime farmland soils are best suited for producing food, feed, forage, fiber, and oilseed crops, and possess qualities favorable for crop production using only acceptable farming methods (National Resource Conservation Service Soil Survey of St Mary Parish, June 2007). Several soil types exist meeting those qualities and are identified as prime farmlands (Appendix A-1: Environmental Resources). Urban areas, like New Iberia and Morgan City, as well as industrial areas, have excluded some prime farmlands from agricultural use.

2.9.16 Sustainability, Greenhouse Gas Emissions, and Climate Change

EO 13423, Strengthening Federal Environmental, Energy, and Transportation Management (January 24, 2007), directs Federal agencies to conduct their environmental, transportation and energy-related activities in an environmentally, economically and fiscally sound and sustainable manner. The USACE strives to protect, sustain, and improve the natural and man-made environment of the Nation, and is committed to compliance with applicable environmental and energy statutes, regulations, and EOs. Sustainability is an overarching concept that encompasses energy, climate change, and the environment to ensure Federal activities do not negatively impact resources for future generations. Proposed alternative plans must

provide for sustainable solutions addressing both short- and long-term environmental as well as social and economic considerations.

Greenhouse gases (GHGs) are components of the atmosphere trapping heat relatively near the surface of the earth and contribute to the greenhouse effect (or heat-trapping) and climate change. Most GHGs occur naturally in the atmosphere from natural processes and events but increases in their concentration result from human activities such as burning fossil fuels. Several studies conclude global temperatures are expected to continue to rise as human activities continue to add carbon dioxide (CO_2), methane, nitrous oxides, and other GHGs to the atmosphere. Whether rainfall increases or decreases remains difficult to project for specific regions.

In 2010, the Council on Environmental Quality (CEQ) released draft guidance on when and how Federal agencies should consider GHG emissions and climate change in NEPA analyses. This draft guidance includes a presumptive effects threshold of 27,563 tons of CO_2 equivalent emissions from a Federal action annually (CEQ, 2010). In 2017, CEQ withdrew Final Guidance for Federal Departments & Agencies on GHG Emissions and Effects of Climate Change in NEPA Reviews.

Climate change impacts within the study area would likely involve increased temperatures (Figure 2-7) and increased precipitation leading to further altered (flashier) hydrologic conditions (Figure 2-8). Annual average temperatures across Louisiana show a trend toward increasing temperature. Any changes in hydrologic conditions occurring within the study area would likely result from less frequent but more intense warm-weather precipitation events, moderately to severely reduced summer flow conditions and degraded water quality.

The character of riparian habitats may also change and invasive species may move into the area with changing climate. Extreme rainfall events and flooding have increased during the last century and these trends are expected to continue, causing erosion, declining water quality, and negative impacts on transportation, agriculture, human health, and infrastructure. The range and distribution of fish and other aquatic species will likely change, and an increase in invasive species would also likely occur.

Additional climate change baseline information and FWOP is found in Appendix C: Hydraulics, Hydrology, and Climate Preparedness and Resiliency. This discussion includes social costs of carbon, nitrous oxide, and methane baseline conditions.

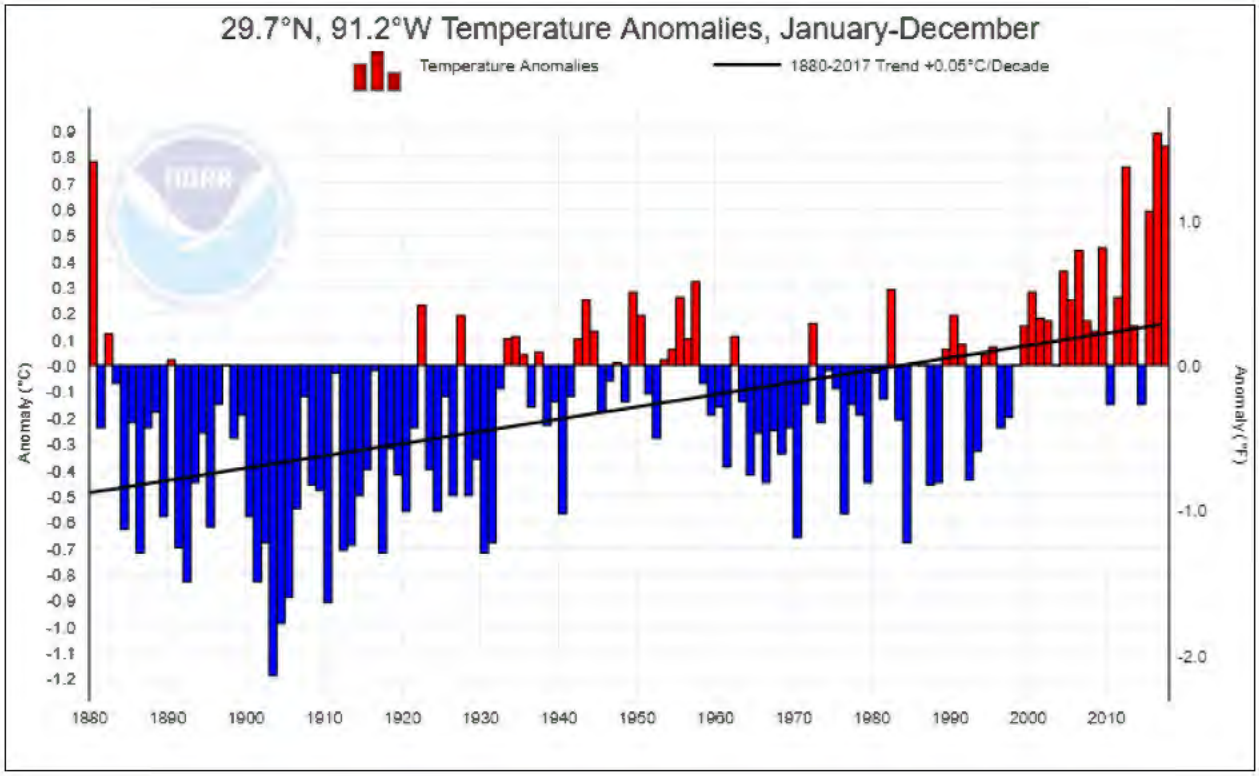


Figure 2-7. Temperature Trend in Louisiana 1880 – 2018 (NOAA1, 2018)

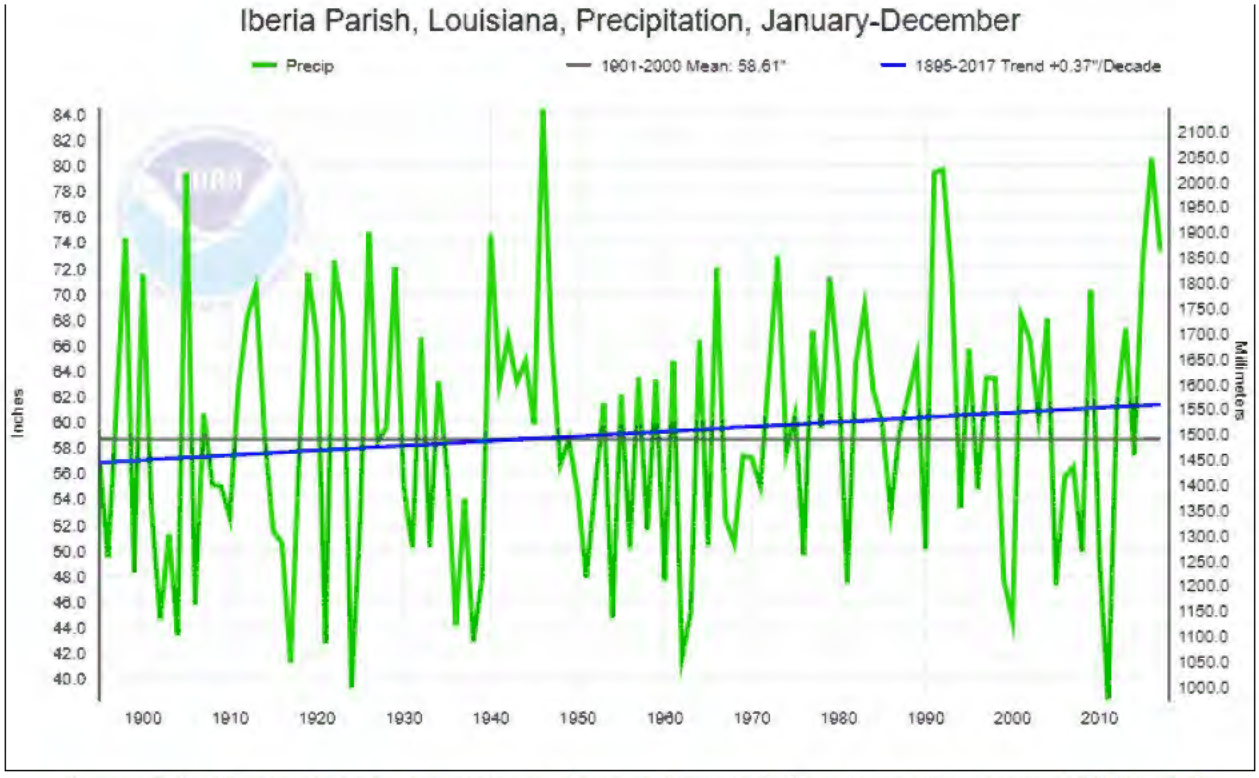


Figure 2-8. Iberia Parish, Louisiana Annual Precipitation in Inches from 1880-2018

(NOAA1, 2018)

Section 3
Formulation of Alternatives

The USACE team conducted plan formulation focusing on achieving the Federal objective of water related resources, which contributes to NED. Formulation was consistent with protecting the Nation's environment, pursuant to national environmental statues, applicable EOs, and other Federal planning requirements. Plan formulation also considers all effects, beneficial or adverse, to each of the four evaluation accounts identified in the Principles and Guidelines (P&G) (1983), which are NED, environmental quality (EQ), regional economic development, and OSE. USACE's goal for this study was to identify a comprehensive strategy to address existing and future coastal risk management. However, the long-term strategy in South Central Louisiana needs to be a layered solution including elements executed by the NFS, other Federal agencies, the State of Louisiana and/or non-governmental organizations.

The plan formulation strategy for this study prioritizes the creation of plans that will address the three main objectives of the study:

1. Reduce risk to life safety from hurricanes and storm surge within St. Martin, St. Mary, and Iberia Parishes over the 50-year period of analysis .
2. Reduce economic loss/damages, as a result of hurricanes and storm surge to structures (i.e., residential, commercial, agricultural, and industrial) within the study area over the 50-year period of analysis.
3. Reduce risk to and enhance reliability of primary evacuation route for study area residents and the greater New Orleans area (Hwy 90) over the 50-year period of analysis.

Following this strategy, the USACE team completed five iterations of the planning process and identified measures, including structural, nonstructural, and nature based measures. Period of analysis was assumed to be 2025-2075.

3.1 ALTERNATIVE FORMULATION STRATEGY

This study was authorized due to coastal storm and flood risks within the study area. The USACE formulated measures to reduce risk to residents, industries, businesses, and critical infrastructure due to riverine or coastal flooding. During the initial formulation, USACE inventoried an initial set of solutions (herein referred to as measures) for consideration from multiple sources (Figure 3-1). Measures meeting the following criteria were carried forward into the initial array of measures.

Figure 3-1. Sources of Possible Solutions in the Study Area

The definition of a measure is a solution or an activity that can be implemented at a specific geographic site to address one or more planning objectives. To be considered as a project measure an activity:

- Could not be a part of the FWOP condition,
- Addresses one or more of the South Central Coast planning objectives;
- Does not violate any of the South Central Coast planning constraints.

Measures listed in Section 3.2 were initially assumed to meet the definition of a project measure and were further assessed. Measures were categorized into three main categories: structural, nonstructural, and natural and nature-based defined as:

1. Structural measures- constructed measures designed to counteract a flood event to reduce the hazard or to influence the course or probability of occurrence of the event.
2. Nonstructural measures- permanent or contingent measures applied to a structure and/or its contents that prevent or provide resistance to damage from flooding. Nonstructural measures differ from structural measures in that they focus on reducing consequences of flooding instead of focusing on reducing the probability of flooding.
3. Natural and nature-based-measures- actions which work with or restore natural processes with the aim of wave attenuation and storm surge reduction.

The USACE team completed multiple iterations of the planning process between the project initiation and selection of the RP, as shown on Figures 3-2 and 3-3. Planning iterations require a USACE team to complete the entire planning process, a single step, or any portion of the planning process for the purposes of reducing uncertainty with each iteration. Iterations repeat, elaborate, refine, correct, or complete a part of the planning process. SCCL planning iterations were a data driven process as such they differ from one another primarily with regard to the information that was utilized and the detail included in the measure evaluation. Iterations one through four evaluated measures separately to determine if each separable element was incrementally justified prior to combining into alternatives as required by ER 1105 2 100. Details regarding

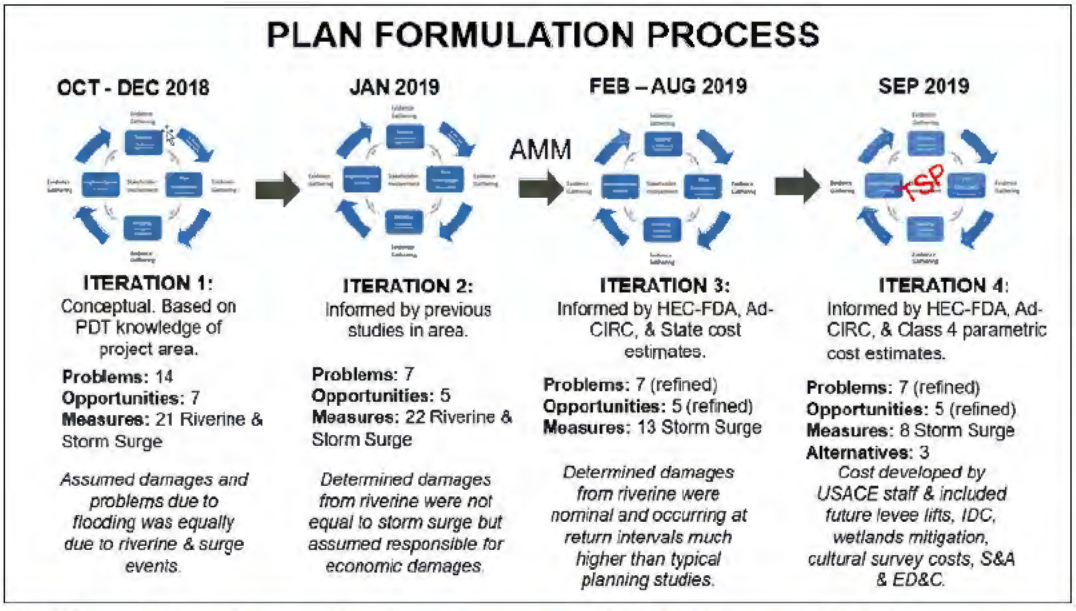
data used in each iteration is summarized in Figures 3-2 and 3-3 and associated technical appendices.

Alternatives were created following completion of iteration four using measures that were incrementally economically justified. Alternatives were further evaluated and compared to identify a TSP. The TSP is a preliminary identification of a preferred alternative, which is released and coordinated as part of the draft integrated feasibility report for public and agency review. Evaluation and comparison of SCCL alternatives is presented in Section 4. Coordination communications and responses are provided in Appendix J:Public Involvement and Scoping.

Following the TSP, feasibility level of design phase began with validation on the final array of alternatives. The feasibility level design phase includes:

- developing sufficiently detailed designs on the TSP in order to improve accuracy of implementation costs, engineering effectiveness, and economic benefits.
- preparing the final feasibility report with identification of the agency recommendation.
- completing a cost schedule risk analysis.

Refinements and optimizations to the TSP are discussed in Sections 4.2 and 4.3 of this report.



HEC-FDA- ver.1.4.2 software uses to estimate flood damages. AdCIRC- Model simulates winds, storm surge, waves, tides, riverine inflows. Supervisory and administration is cost applied to the contract to cover labor and supervisory and administration of the contract. IDC- Interest applied during the estimated construction period. ED&C – Engineering, design, and construction labor estimates for PED and implementation phase. AMM is a USACE planning milestone.

Figure 3-2. South Central Coast Plan Formulation Process- Iterations 1-4

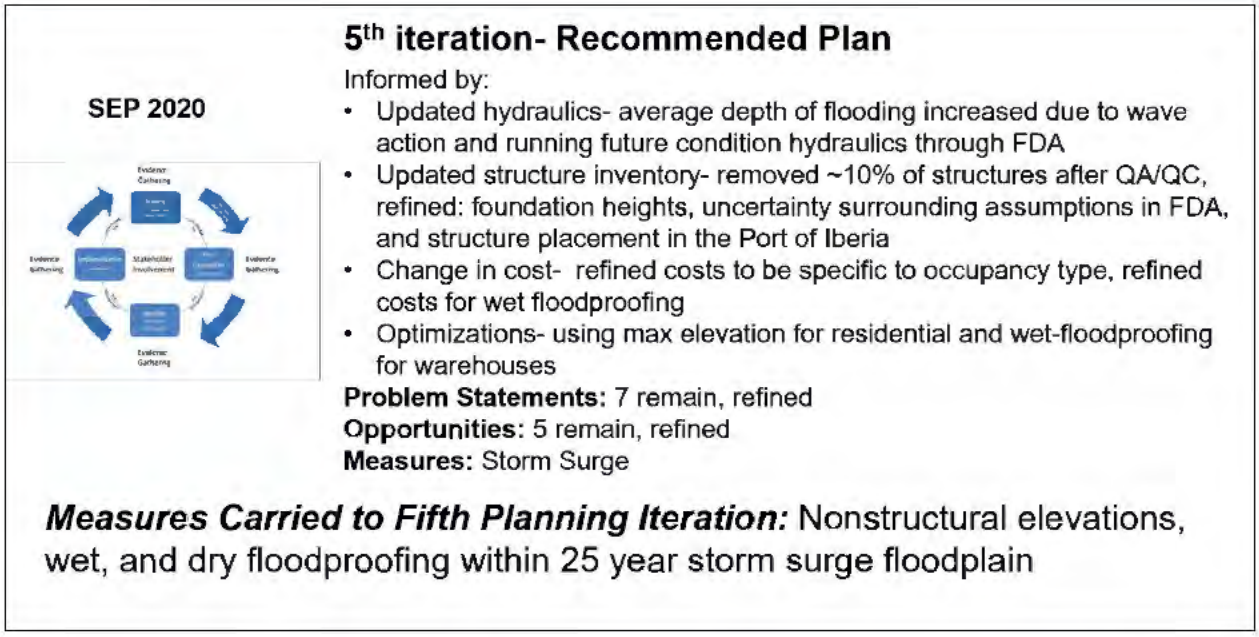


Figure 3-3. South Central Coast Plan Formulation Process- Iteration 5

3.2 MANAGEMENT MEASURES

As described in Section 3.1, a variety of input was sought to identity a full variety of measure types. Twenty two measures were identified. Variations on initial measures occurred upon further refinement and are described under each iteration. The planning team evaluated each independent measure separately to determine if the measure was economically justified in accordance with ER 1105 2 100 and WRDA 1986. Criteria for justification requires a benefit-cost ratio (BCR) of greater than 1.0. Measures that justify incrementally would then be combined into alternatives. Section 4 Evaluation and Comparison of Alternatives, describes measures which met ER 1105 2 100 and WRDA 1986 requirements.

3.2.1 Structural Measures

Measures 1, 2, 3, and 4 - Build a comprehensive levee system with interior drainage pumps and gates. The project delivery team (PDT) considered and evaluated three comprehensive levee alignment variations and one interior pump measure.

- Measure 1- State Alignment A. Building of a comprehensive levee with interior pumps and gates, primarily constructed in wetland habitat. State Alignment A has an additional alignment variation that includes a levee extension down Highway 83 (Figure 3-4).
- Measure 2- State Alignment B. Building of a comprehensive levee with interior pumps and gates, primarily constructed on agricultural lands. State

Alignment B has an additional alignment variation that includes a levee extension down Highway 83 (Figure 3-4).

- Measure 3 - Building of a comprehensive levee with interior pumps and gates running directly south and parallel to Hwy 90 within the study area, as illustrated in Figure 3-4. The USACE team identified the Hwy 90 comprehensive levee alignment. The intent of the Hwy 90 alignment was to reduce risk to the main evacuation route and because Highway 90 is further inland, design heights were likely to be lower and less costly then alignments A and B. Hwy 90 would not be elevated in this measure.
- Measure 4 - Interior drainage pumps. Nine interior drainage pumps are included in the comprehensive levee system. Pump locations are expected to be similar across each comprehensive levee system alignment at existing drainage canals. Pumps represent one of the management measures within the total of 22 measures initially identified. Pump locations and channel capacity were identified by CPRAB report referenced in Section 1.9 Study Authority and Prior Reports and Existing Water Projects. The USACE team evaluated and validated identified channels and capacity design assumptions.

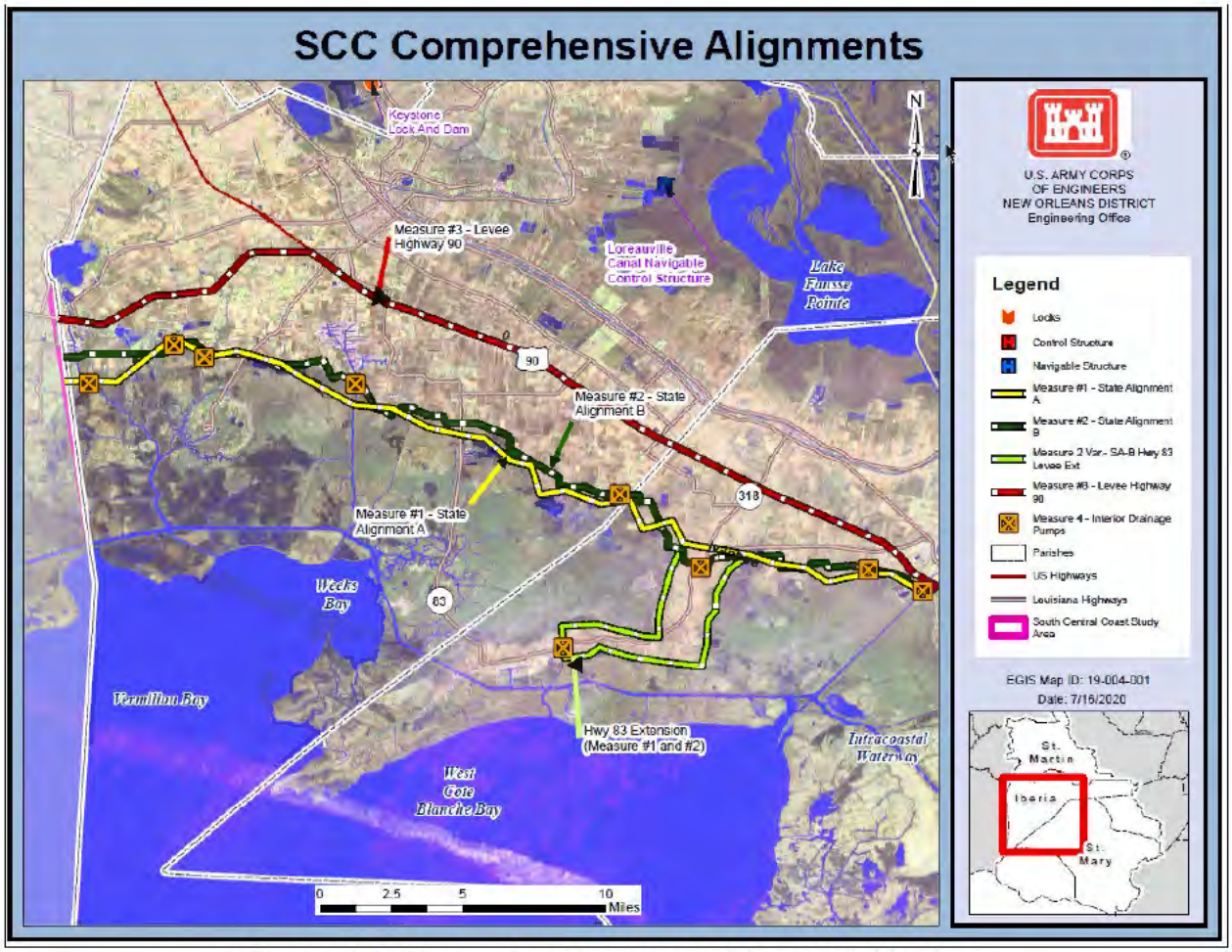


Figure 3-4. Comprehensive Levee Alignment Measure

Measures 5 and 6 - Raise existing Atchafalaya Riverine levee systems. Evaluation of levee raise measures were divided between levees east and west of Wax Lake outlet: Measure 5, elevation of the existing levee Morgan City back levee is to the east of Wax Lake outlet (Figure 3-4) and Measure 6, elevation of levees west of Berwick is to the west of Wax Lake outlet (Figure 3-5). Both Measures 5 and 6 would raise levees to 0.01 AEP hurricane and storm surge risk reduction using HSDRRS design standards.

Existing levees, authorized for Atchafalaya River risk reduction, located along the eastern side of SCCL study area, reduce riverine flooding from the Atchafalaya River. The O&M of existing levee segments is mixture of NFS and Federal responsibility. The O&M is performed regularly. The last inspection performed in 2018 did not identify imminent danger or any sort of critical condition. The LSAC of all classified levees and structures in the study area is II (urgent). Levee enhancements are expected to require future levee lifts throughout the design life as a result of subsidence and RSLR. Planning and engineering assumptions on levee lifts are provided in Appendix B: Engineering. USACE cost estimates and (BCR) ratio reflect enhancements completed by St. Mary Levee District. See Section 3.4, Measure Evaluation and Screening, for

details on results of the assessments

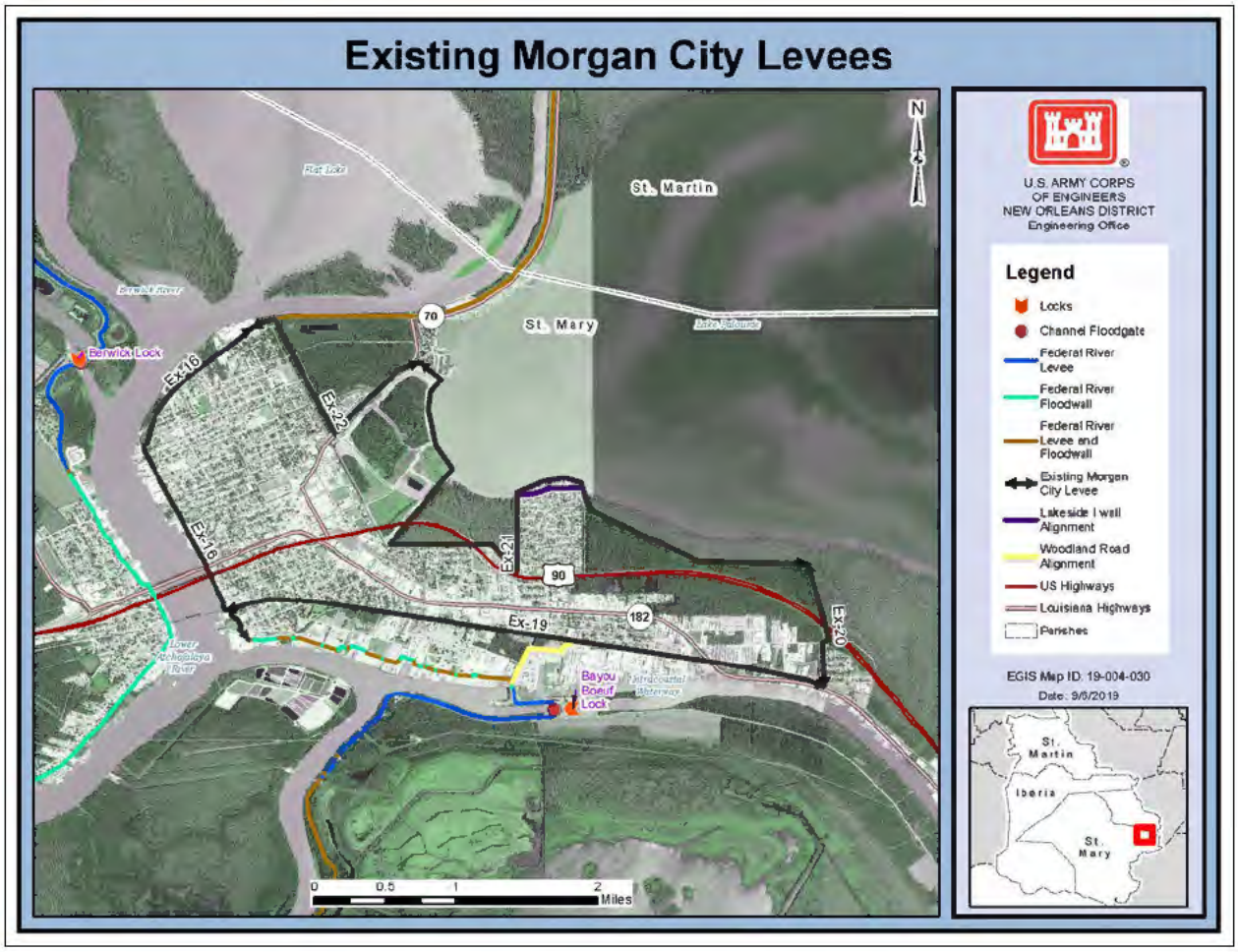


Figure 3-5. Morgan City Levee Raises

Levees West of Berwick are comprised of subsegments Ex-1- Ex-8. Measure 6 would result in the elevation of all Ex-1 to Ex-8 subsegments to the 0.01 AEP hurricane and storm surge risk reduction using HSDRRS design standards (Figure 3-6).

Figure 3-6. Evaluation of Existing Levees West of Berwick with Sub Segment Identified

Measure (7, 8, 9) - Construct ring levees to protect key population centers and/or key infrastructure. Locations for ring levees and key infrastructure ring levees were identified by assessing recurring damages hot spots and expected annual damage maps (Figure 3-7). The recurring damages within the study area are limited, based on historic data. Three variations of conceptual ring levee alignment were identified south of the City of New Iberia (Figure 3-7).

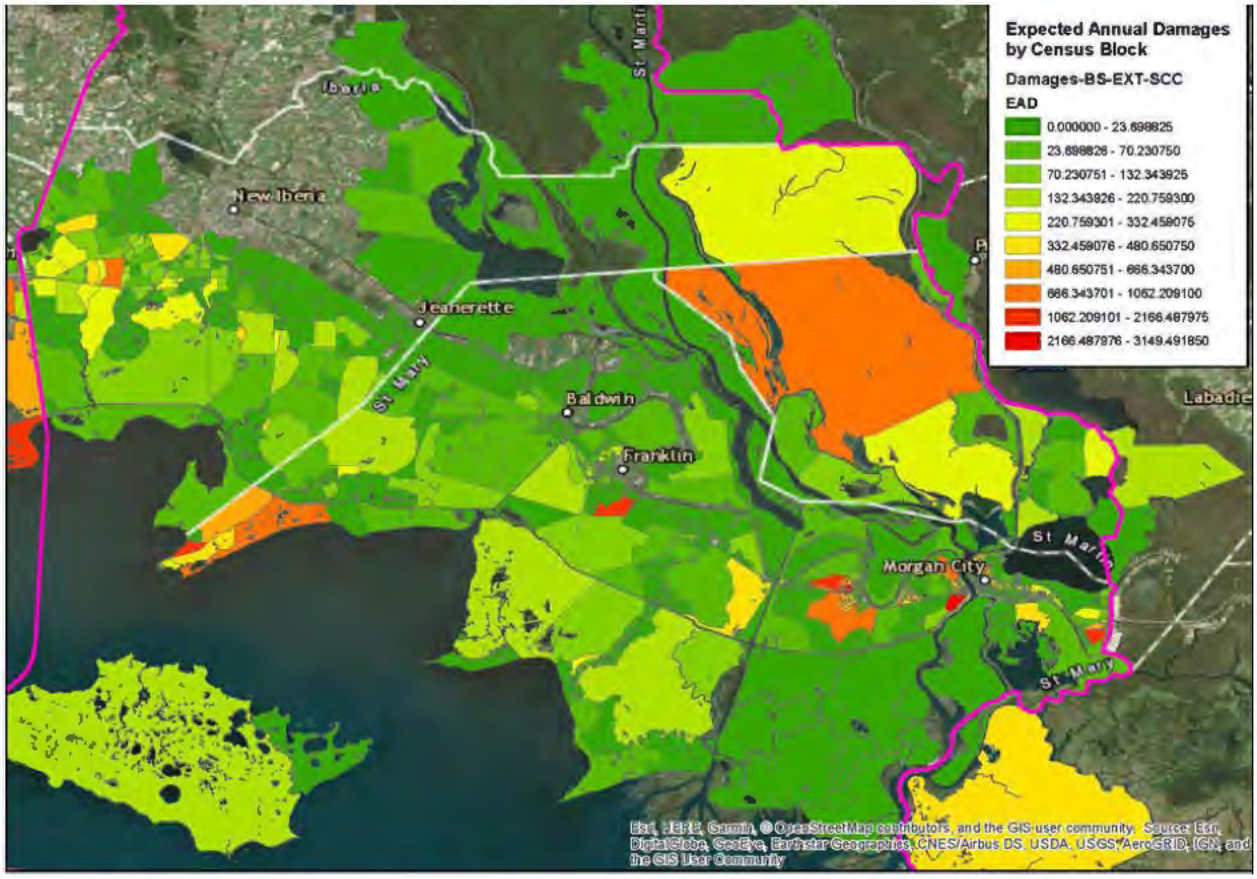


Figure 3-7. Reoccurring Damage Hot Spot by Census Block with Study Area

Measure 7 is ring levee 1, which starts on the west side of the study area, east of the City of Delcambre, Louisiana. The City of Delcambre is half in the study area, making a comprehensive coastal storm risk reduction solution challenging. Ring levee 1 is 57,448 linear feet. New levee construction is expected to require future levee lifts throughout the design life as a result of subsidence and RSLR. Planning and engineering assumptions on levee lifts are provided in Appendix B: Engineering. Ring levee 1 would include pumping stations and navigation gates at key drainage canals similar to the comprehensive levee.

Measure 8 is ring levee 2, which starts on the east side of the City of Delcambre and encompasses the City of New Iberia, Louisiana and the Port of Iberia. Ring levee 2 is 50,565 linear feet. New levee construction is expected to require future levee lifts throughout the design life as a result of subsidence and RSLR. Planning and engineering assumptions on levee lifts are provided in Appendix B: Engineering. Ring levee 2 would include pumping stations and navigation gates at key drainage canals similar to the comprehensive levee.

Measure 9 is ring levee 3 located furthest east of the ring levees, beginning east of Port of Iberia along Weeks Island Road and encompassing the town of Lydia and extending toward City of New Iberia, Louisiana. Ring levee 3 is 35,961 linear

feet. New levee construction is expected to require future levee lifts throughout the design life as a result of subsidence and RSLR. Planning and engineering assumptions on levee lifts are provided in Appendix B: Engineering. Ring levee 3 would include pumping stations and navigation gates at key drainage canals similar to the comprehensive levee.

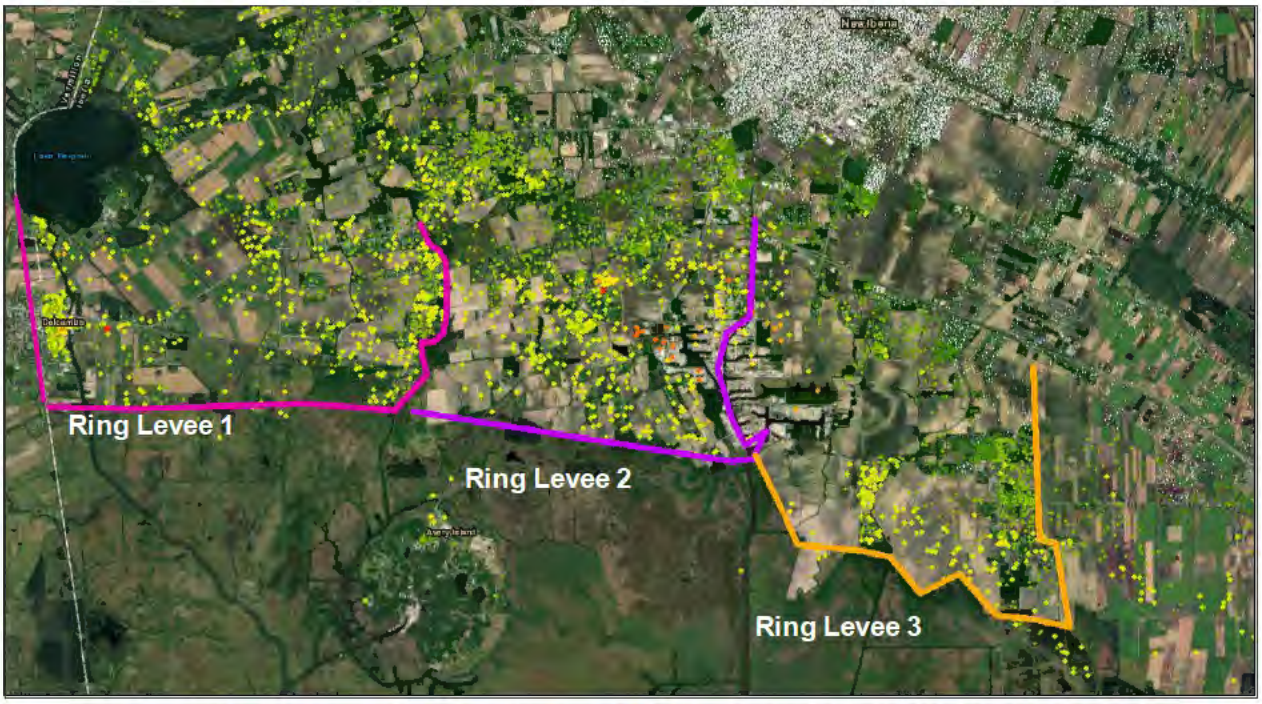


Figure 3-8. Conceptual Ring Levee Measures for the South Central Coast

Ring levee segments were further refined following the third planning iteration. Rationale for refinement is discussed in Section 3.4, Measure Evaluation and Screening. Refinement was based on likelihood of economic justification. The variation resulted in a combination alignment of Ring levees 1 and 2 as shown in Figure 3-9. The alignment provides storm surge damage reduction benefits on the east side of the City of Delcambre, City of New Iberia, and the Port of Iberia. Ring levee 1+2 is 88,272 linear feet. Planning and engineering assumptions on levee lifts are provided in Appendix B: Engineering. Ring levee 1+2 would include pumping stations and navigation gates at key drainage canals similar to the comprehensive levee.

Figure 3-9. Combined Ring Levees Conceptual Alignment 1 +2

It was assumed construction of a comprehensive levee, ring levees, or levee elevations would require future levee lifts due to settling and subsidence within the study area. Quantities were developed for EX-1, the ring levees and the Morgan City gaps. EX-2 through 7 quantities were developed, but at a much lower level due to them being screened. Remaining levee alignment costs used NFS estimates developed and published in the Louisiana's Comprehensive Master Plan, 2019. Engineering assumptions regarding levee lifts is documented in Appendix B: Engineering. A summary of future levee lifts and length is presented in Table 3-1. Costs associated with future levee lifts were included in the cost and benefit analysis.

Table 3-1. Summary Table of the Levee Lift Assumptions

				Lift Elevation (feet)		
Reach	**Width (feet)**	**Length (miles)**	**Area (acres)**	**2.5 ft 5- 7 Yr Post Construction**	**1.5 ft 15-20 Yr Post Construction**	**1 ft 30 Yr Post Construction**
Levees West of Berwick (EX1)	127	18.5	262	13.0	14.5	15.5
Morgan City Back Levee (EX 19)	92	0.6	9	9.0	10.5	11.5
Ring Levee 1	235	10.9	310	23.8	25.3	26.3
Ring Levee 2	223	9.6	259	22.1	23.6	24.6
Ring Levee 3	201	6.8	166	19.5	21.0	22.0

Measure 10- Construct gates at key bridges and/or navigation channels. Sluice and/or barge gates would be a dependent measure for the comprehensive levee system, ring levee systems, and raising of existing levee segments previously described.

The primary purpose of these gates includes:

- reduce storm surge impacts,
- allow for interior drainage during rainfall and riverine flooding events, and
- avoid impacts to navigation.

Sluice gate locations and estimated costs would occur at nine identified pump locations (Table 3-2 and Figure 3-10). The design flow of the 0.04 AEP (25-year event) was used because it represents a conservative estimate for rainfall intensity during a hurricane event. This design flow would ensure gates were appropriately designed to allow for interior drainage during a rainfall event and prevent induced flooding from construction of a levee.

Table 3-2. Proposed Navigational Gate (Steel Barge Gate)

		Design Flow for 25 Yr Event	Barge Gate Size (Ft)	Total Costs
Iberia Parish	Delcambre/Avery Canal	1530 cfs	110	$30,250,000
	Poufette Canal	3720 cfs	30	$8,250,000
	Petit Anse Canal	5800 cfs	30	$8,250,000
	Commercial/Rodere Canal	5200 cfs	200	$55,000,000
	Delahoussey Canal	2420 cfs	30	$8,250,000
St. Mary Parish	Ivanhoe Canal	90 cfs	N/A	N/A
	Bayou Choupique	2440 cfs	30	$8,250,000
	Bayou Teche/Charenton Canal	4000 cfs	110	$30,250,000

Measure 12-Create wave /storm surge attenuation structures in front of new or existing levee segments. Wave break/attenuation structures are dependent upon justified levees. The primary purpose of this measure would be to reduce storm surge wave heights and long-term O&M cost for justified levees. Wave heights can be substantive, 4 to 5 feet have been modeled for the 0.01 AEP storm surge event, in this region. Best professional judgment was used to identify reduction in operation and maintenance costs provided by this measure if structural features are determined to be justified in the RP.

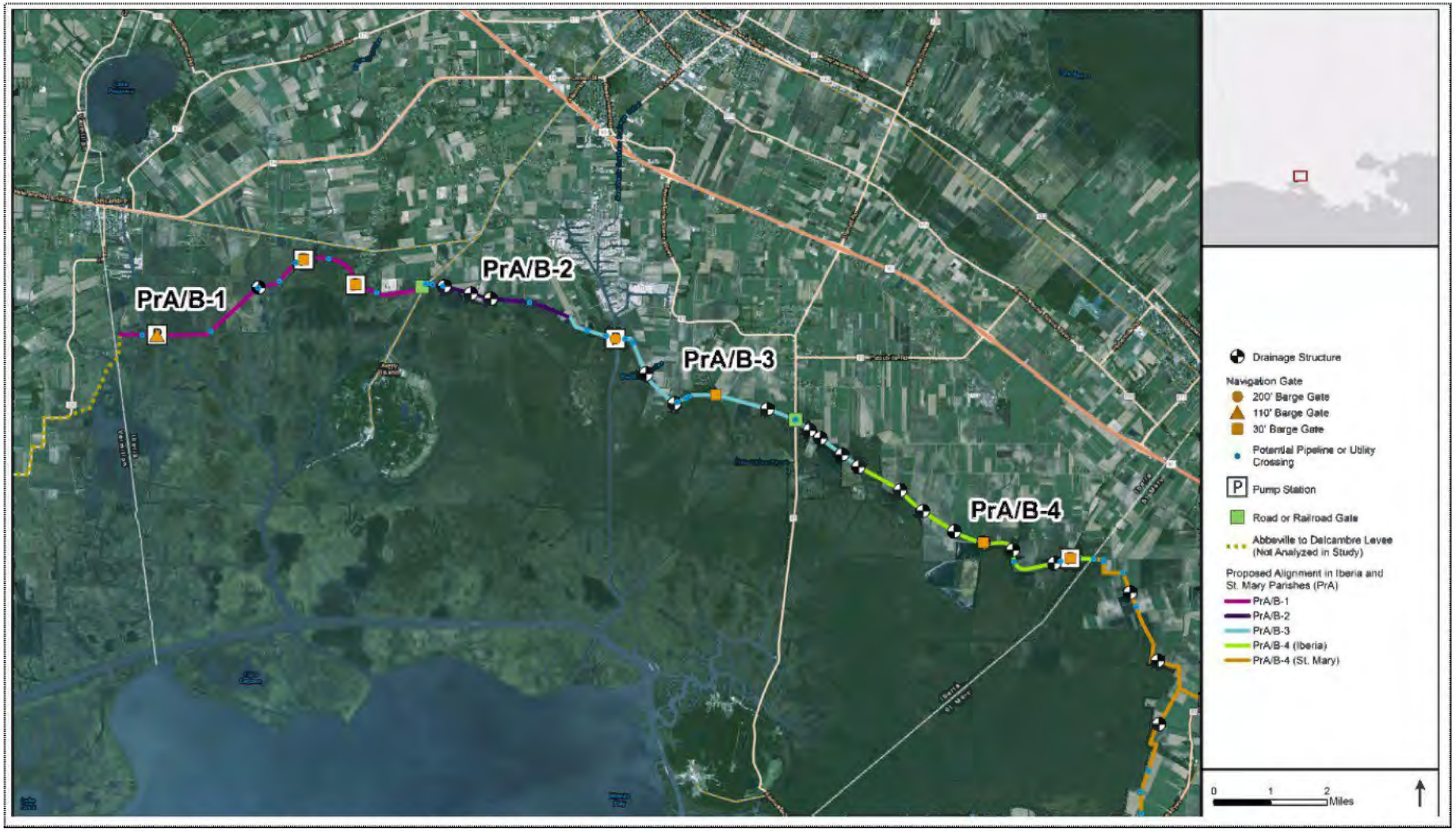


Figure 3-10. Structural Sluice Gate and Pump Station Location Illustrated in the 2017 CPRA Report

3.2.2 Nonstructural Measures

Nonstructural measures are permanent or contingent measures applied to a structure and/or its contents that prevent or provide resistance to damage from flooding. Nonstructural measures differ from structural measures since they focus on reducing consequences of flooding instead of focusing on reducing the probability of flooding, example evacuation plan development is a measure focused on reducing life safety consequences of flood events. Nonstructural measures identified by the USACE team for evaluation include:

Measure 11 Elevate and/or floodproofing (wet or dry). Elevation of a structure is the action of constructing the habitable space of a structure above the BFE. Elevate structures is anticipated to reduce damages associated with flood depths of 3 to 13 feet above ground surface elevation.

Dry floodproofing is a combination of methods that make a building and attendant utilities and equipment watertight and substantially impermeable to floodwater, with structural components having the capacity to resist flood loads.

Wet floodproofing is the permanent or contingent methods applied to a structure and/or its contents that prevent or provide resistance to damage from flooding by intentionally allowing floodwater to enter and exist the structure automatically. Wet floodproofing is allowed in limited situations based on structure type, structure use, and require a variance from in compliance with 44 CFR Section 60.3. There are three main components to wet floodproofing a structure; 1) design elements 2) flood resistant materials and 3) protection of contents.

1- *Design elements*- Protection of the structure itself must be considered in floodproofing designs. Hydrostatic forces must be counteracted to prevent wall collapse and flood-induced uplift. This is achieved through the use of wall openings that allow flood water to enter and exist the structure, thereby equalizing the hydrostatic pressure.

2- *Flood resistant materials*- All materials shall be capable of resisting damage associated with a base flood event. Components not inundated with flood water must be able to resist damage as a result of excessive humidity associated with flooding and post-flood conditions . Protection of mechanical and electrical systems are required to be designed and/or located so as to prevent flood water from entering or accumulating within them.

3- *Protection of Contents*- Damages to contents within the structure that are not part of the structure envelope and building functionality. Contents may include office space and materials specific to operations of the building tenant.

Three floodplain aggregations were evaluated as part of these measures. Floodplains evaluated include the 25-year, 50-year, and 100-year storm surge floodplains and will

be referred to as Measure 11 variation a, b, and c, respectively. Elevations will not exceed 13 feet above ground surface elevation due to wind impacts. Elevation required to mitigate future frequency flood depths significantly changed between the frequencies tested. The average height required to elevate residential structures for the 0.02 AEP frequency was 6.7 feet for one-story structures, 6.3 feet for two-story structures, and 5.8 feet for mobile homes. Dry floodproofing elevations will not exceed 3 feet above ground surface elevation due engineering constraints on building structure. For the 0.04 AEP frequency one-story structures would require 11.6 feet of elevation, two-story structures would require 10.8 feet of elevation, and mobile homes would require an average of 10.4 feet of elevation.

Figure 3-11. Dry Floodproofing Method Installed On Building Entrance

Figure 3-12. Wet Floodproofing- Vents Installed in Metal Fabricated Structure Type

Measure 15 - Operational optimization for event scenarios on existing infrastructure. - The primary purpose of this measure is to operate existing pump station infrastructure more effectively to reduce flood risk. The study assessed existing operational manuals and trigger points to determine if hydrologic conditions have changed based on type of storm event and if systematic changes in operations would reduce damages. Existing pump structures evaluated are illustrated in Figure 1-2. Existing Infrastructure.

Measure 16 - Acquisition and relocation of structures within the 25 year Floodplain. The primary purpose of this measure is to reduce flood damages by removing existing residential and commercial infrastructure from the 25-year storm surge floodplain. The study will assess the feasibility of acquiring residential and commercial infrastructure within a frequently damaged floodplain and verify that removing the structures would provide the highest net benefits over the project planning horizon. The 25-year floodplain was selected based on economic hot spot analysis and reoccurring damages.

3.2.3 Natural and Nature Based Measures

Natural and nature-based measures work with or restore natural processes, SCCL focused plan formulation on wave attenuation and storm surge reduction, locations of the natural and nature-based measures are shown in Figure 3-13.

Measure 13-Construct shoreline protection along Vermilion Bay. The purpose of this measure is to prevent erosion and reduce impacts of storm surge and shoreline erosion. Additionally, this measure could prevent continued degradation of the marsh habitat that acts as a storm surge barrier.

Measure 14- Construct Water Retention Features on Inside of Levees. This measure is dependent upon a comprehensive levee system or ring levee locations being economically justified. The purpose of this measure is to replace or reduce size of pumps needed at key canal locations. The NFS estimated a cost of $1.4 to $1.5 billion for the comprehensive levee system, with pumps accounting for 35 percent to 40 percent of the total cost estimate (CPRAB. South Central Coast Louisiana Flood Protection Study, 2017). The USACE team identified water retention locations as a potential cost saving measure. Ancillary environmental benefits may also occur at these retention areas.

Measure 17- Restoration of marsh habitat on Marsh Island. Marsh habitat is a natural barrier for storm surge and riverine flooding by retaining water. Marsh island is expected to be significantly underwater in the moderate and high relative sea level scenarios. This measure would include restoration of marsh habitat on marsh island. Measure would require elevation of the existing marsh island.

Measure 18 Construct Marsh Island Inlet Closure. An inlet closure structure was identified by public and local municipalities. Locals stated that as the inlet widened over time storm surge and wave impacts have increase negative effects on the study area through the restoration of the inlet. The purpose of this measure would be to reduce storm surge and wave impacts on study area. Depths to bottom of the inlet are estimated at 50 and 60 feet, with maximum depths up to 100 feet.

Measure 19 Construct Wave Attenuation Structures near Marsh Island. The primary purpose of these features would be to reduce storm surge wave heights, which can be substantive in the study area. These features would be constructed with methods similar to oyster reef restoration. Generally, a slurry of concrete and dead oyster shells are constructed parallel to the coast. Wave heights of 4-5 feet have been modeled for the 0.01 AEP percent event, in this region.

Measure 20 Restore Rabbit and Duck Keys. Barrier island features can reduce storm surge and wave heights. Rabbit and Duck Keys were historically off the coast of south central Louisiana. As a result of erosion, RSLR and subsidence, both Rabbit and Duck Keys are no longer island features. These features would likely need to be implemented with other natural features to reduce the impacts of storm surge and wave heights.

Restoration of Rabbit and Duck Keys was identified by public and local municipalities. Locals stated that as barrier islands were eroded over time, storm surge and wave heights impacts have increase negative effects on the study area

Measure 21 Cote Blanche Freshwater Sedimentation Introduction. The primary purpose of this measure, as described by the Chitimacha Tribe in a letter of support to the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Task Force dated January 27, 2012, will reduce interior land loss and promote land building, reduce shoreline erosion rates and protect critical marsh habitat, and maintain lower energy hydrology of the Cote Blanche wetlands.

Table 3-3 illustrates how measures align with project problems, opportunities, and objectives.

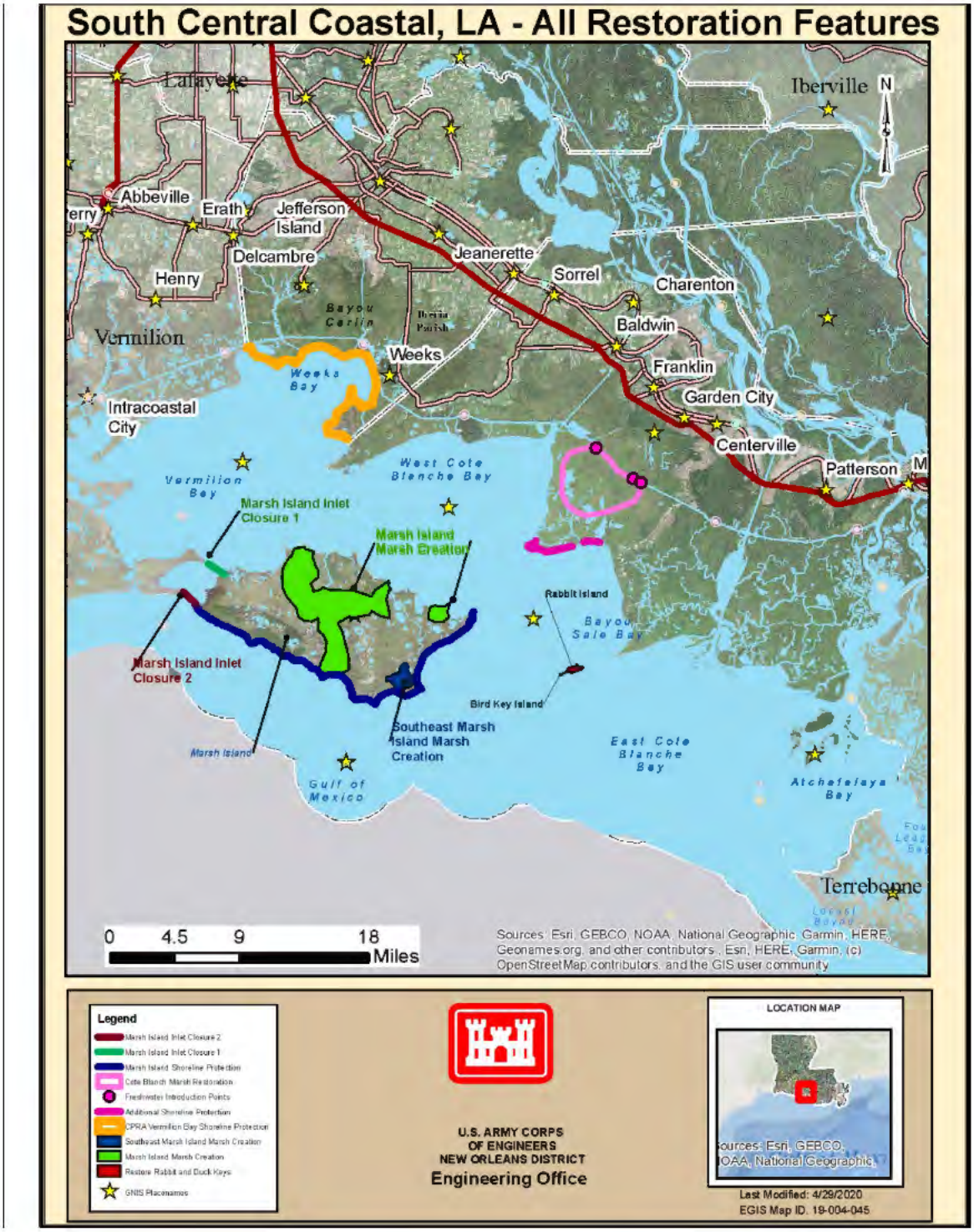


Figure 3-13. Natural and Nature Based Measure Locations

Table 3-3. Project Alignment with Study Area Problems, Opportunities and Objectives

Problems	Opportunities	Objectives	Measures
Flooding from tidal surge and waves associated with tropical storms and hurricanes	Raise or remove buildings out of the floodplain. Block surge with levees and floodgates.	Objective 2. Reduce economic loss/damages, as a result of hurricanes and storm surge to structures (i.e., residential, commercial, agricultural, and industrial) within the study area over the 50 year period of analysis.	Structural - Comprehensive levees system, ring levees, floodgates, floodwalls, pumps Nonstructural - Elevate existing structures, acquire existing structures, update evacuation procedures Nature Based Features - Marsh restoration, coastal shoreline protection, barrier island construction
Study area population of approximately 177,000 people are at risk during hurricane, storm surge events.	Reduce life safety risk	Objective 1. Reduce risk to life safety from hurricanes and storm surge within St. Martin, St. Mary, and Iberia parishes over the 50 year period of analysis.	Structural - Comprehensive levees system, ring levees, floodgates, floodwalls, pumps Non -Structural Elevate existing structures, acquire existing structures, update evacuation procedures Nature Based Features - Marsh restoration, coastal shoreline protection, barrier island construction
Flooding from riverine and storm surge inundate portions of Hwy 90, the main evacuation route, and slows recovery of area following events.	Protect critical portions of Hwy 90 to allow for safe evacuations and assist in recovery of communities following events	Objective 3. Reduce risk to and enhance reliability of primary evacuation route for study area residents and the greater City of New Orleans area (Hwy 90) over the 50 year period of analysis.	Structural - Comprehensive levees system, ring levees, floodgates, floodwalls, pumps

3.3 MEASURE DEPENDENCIES

Measures can be classified as independent or dependent measures. Measures that are dependent must be combined with another measure in order to be implemented and therefore cannot be a stand-alone alternative. Measures that are independent may be a stand-alone alternative or may be combine with other measures. Table 3-4 identifies each measure as independent or dependent.

Table 3-4. South Central Coast Measure Dependencies and Combinability

Measure Title	Structural Measures														
	Measure 1 Levee A	Measure 2 Levee B	Measure 3 Levee Hwy 90	Measure 4 Interior Pumps	Measure 5 MCBL	Measure 6 LWB	Measure 7 RL 1	Measure 8 RL 2	Measure 9 RL 3	Var. Measure 8 RL 1+2	Measure 10 Gates	Measure 11 Floodproof & Elevation	Measure 12 Wave attenuation	Measure 15 Operational Optimization	Measure 16 Acquisition
Measure 1- Levee A				D, C	C	C					D, C		D, C		
Measure 2- Levee B				D, C	C	C					D, C		D, C		
Measure 3- Levee Hwy 90				D, C	C	C					D, C		D, C		
Measure 4- Interior Pumps	D, C	D, C	D, C		D, C	D, C	D, C	D, C	D, C	D, C	D, C	C	D, C		
Measure 5- MCBL	C	C	C	D, C		C	C	C	C	C	D, C	C	D, C	C	C
Measure 6- LWB	C	C	C	D, C	C		C	C	C	C	D, C	C	D, C	C	C
Measure 7- RL 1				D, C	C	C					D, C	C	D, C	C	C
Measure 8-RL 2				D, C	C	C					D, C	C	D, C	C	C
Measure 9-RL 3				D, C	C	C					D, C	C	D, C	C	C
Measure 8 var.- RL 1+2				D, C	C	C					D, C	C	D, C	C	C
Measure 10-Gates	D, C	D, C	D, C	D,C	D, C	D, C	D, C	D, C	D, C	D, C		C	D,C	C	C
Measure 11- Floodproof & Elevation	NA	NA	NA	NA	C	C	C	C	C	C	C		C	C	
Measure 12- Wave attenuation	D, C	D, C	D, C	D, C	D, C	D, C	D, C	D, C	D, C	C	C	C		C	C
Measure 13- VB Shoreline Protection	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Measure 14-Water Retention	D, C	D, C	D, C	D, C	D, C	D, C	D, C	D, C	D, C	C	C	C	C	C	C
Measure 15- Operational Optimization	C	C	C	C	C	C	C	C	C	C	C	C	C		C
Measure 16- Acquisition	C	C	C	C	C	C	C	C	C	C	C	C	C	C	

Dependencies = D
Combinability = C
NA= Not Applicable;
Grey indicates not combinable or dependent
Some natural and Nature Based measures are not shown in matrix as they are combinable with both structural and nonstructural measures.

3.4 MEASURE EVALUATION AND SCREENING

Iterations 1 – 4 evaluated measures separately to determine if each separable element was incrementally justified prior to combining into alternatives as required by ER 1105 2 100. Sections 3.4.1-3.4.4 document data used in each iteration and evaluation methods.

3.4.1 Initial Screening of Measures

Measures were not screened between the first and second iterations. Following the second iteration, measures were screened based on how well they addressed planning objectives and 1983 Economic and Environmental P&G for Water and Related Land Resources Implementation Studies (U.S. Water Resource Council 1983) criteria. The four P&G criteria are: completeness, effectiveness, efficiency and acceptability. Each measure was rated with a high, medium, or low for each criteria. Table 3-5 documents criteria rating for each measure, determination to screen or carry forward to the next iteration and describes the rationale for screening of measures prior to the third planning iteration.

The definitions of these terms are:

- Completeness – The extent to which the alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects.
- Effectiveness – The extent to which an alternative plan alleviates the specified problem and achieves the specified objectives.
- Efficiency – The extent to which an alternative plan is the most cost-effective means of alleviating the specified problem and achieving the specified objectives.
- Acceptability – The workability and viability of the alternative plan with respect to acceptance by state and local entities and the public and compatibility with existing laws, regulations, and public policies.

Screened measures included:

Measure 1 - Build a comprehensive levee system alignment A with interior drainage pumps and gates. This measure was screened because it was determined to be not efficient. The alignment would require additional costs (when compared with Measure 2), such as extensive wetland survey, mitigation, and monitoring. No additional benefits, would be expected from the alignment. Additional costs associated with wetland mitigation were determined unlikely to result in an economically justified measure and not efficient.

Measure 3 - Build a comprehensive levee system Hwy 90 alignment with interior drainage pumps and gates. The alignment is directly south of highway 90 and has an increase in number of road intersections, when compared to measures 1 and 2, giving access to residential and commercial structures south of the alignment. The alignment would require a minimum of twenty highway gates to allow for traffic evacuation south of

the alignment. Additional costs associated with crossings and closure gates were determined unlikely to result in an economically justified measure. This measure was screened because it was determined to be not efficient.

Measure 12 - Create wave /storm surge attenuation structures in front of new or existing levee segments. This measure was identified as a dependent measure on justified levee measure. Wave attenuation structures would not be effective in reducing storm surge damages alone. Measure was screened following determination that structural plans were not justified.

Measure 13 - Construct shoreline protection along Vermilion Bay. This measure was screened because hydrologic modeling verified that the existing shoreline is not the erosional surface during storm surge events making this measure not effective in reducing storm surge damages to structures.

Measure 14 - Construct water retention features inside levees. Based on modeled flow, there is not enough available land (regardless of methods of acquisition) to locate retention features sufficient in size for water retention requirements. This measure was intended to reduce size, and therefore, cost of pumps needed within structural alternatives. The measure would not eliminate the need for pumps completely. Results of economic analysis of structural measures carried through the third iteration (Section 3.4.3) provide further evidence that this measure would not provide enough cost savings to make the structural measures economically justified. This measure was screened because it was determined to be not efficient.

Measure 15 - Operational Optimization for Event Scenarios. Operational trigger points were reviewed and determined that current operations procedure require pump activation at 0 feet mean sea level. Activation of pumps at a lower trigger point would increase operation and maintenance costs by requiring supervision of pumps earlier in storm readiness procedures. Additionally, running of pumps at lower water conditions may result in pump damage. This measure was deemed to be ineffective and not efficient.

Measure 17 - Restoration of marsh habitat on Marsh Island. The distance of Marsh Island to the mainland shoreline is approximately 5 miles. Engineering design considerations suggest 2-3 wavelength in advance of feature intending to protect. Wavelengths vary based on wave height; however, within the Gulf of Mexico the average wavelength is 230 feet. This distance is too far to reduce on storm surge or wave heights reduction. Therefore, restoration of Marsh Island would have limited effect on reducing storm surge. This measure was deemed to be ineffective and not efficient.

Measure 18 - Marsh Island Inlet Closure Structure. The distance of Marsh Island to the mainland shoreline is approximately 5 miles. Engineering design considerations suggest 2-3 wavelength in advance of feature intending to protect. Wavelengths vary based on wave height; however, within the Gulf of Mexico, the average wavelength is 230 feet. Therefore, construction of an inlet closure near Marsh Island would have

limited effect on reducing storm surge. Additionally, the inlet depth is estimated to be an average of 50-60 feet, with maximum depths up to 100 feet. Material to construct the closure would likely be cost prohibitive when compared to effect on reducing storm surge damages. This measure was deemed to be ineffective and not efficient.

Measure 19 - Wave Attenuation Structures near Marsh Island. The distance of Marsh Island to the mainland shoreline is approximately 5 miles. Engineering design considerations suggest 2-3 wavelength in advance of feature intending to protect. Wavelengths vary based on wave height; however, within the Gulf of Mexico the average wavelength is 230 feet. Therefore, construction of a wave attenuation structures near Marsh Island would have limited effect on reducing storm surge. This measure was deemed to be ineffective and not efficient.

Measure 20 - Restore Rabbit and Duck Keys. The distance from Rabbit and Duck Keys to the mainland shoreline is approximately 5 miles. Engineering design considerations suggest 2-3 wavelength in advance of feature intending to protect. Wavelengths vary based on wave height; however, within the Gulf of Mexico the average wavelength is 230 feet. Therefore, restoration of Rabbit and Duck Keys near Marsh Island, 5 miles from the mainland, would have limited effect on reducing storm surge. This measure was deemed to be ineffective and not efficient.

Measure 21 - Cote Blanche Freshwater Sedimentation Project. The Cote Blanche Sedimentation Project area has a very low amount of residential and commercial structures. The low amount of structures results in low reoccurring damages within the proposed project boundary. Additionally, previous USACE project evaluations under other federal programs identified significant pipeline relocations resulting in significant cost increase and the determination to not implement the project. This measure was deemed to be ineffective and not efficient and did not address SCCL project objectives.

Measure 22 - Reef Restoration. An additional measure was proposed by a public attendee during an open house held in December 2019. The 16-mile reef restoration measure involves construction of large, submerged, sectional breakwaters behind Marsh Island in Vermillion bay and West Cote Blanche bay. The intent is to restore and reinforce old oyster reefs to assist in reducing energy during surge events. Although local wave reduction would occur near the submersed structures, there remains enough distance (approximately 5 miles) between the structure to landfall allowing for wave energy (fetch) to rebuild up in route. Additionally, the volume of water behind the breakwaters would likely succumb to seiche during high-wind surge events. The primary aim of this study is to reduce storm surge risk and damage to structures. Although this measure was not screened in the second iteration (the team became aware of it after that iteration had occurred), the rationale for screening is similar to Measures 19 and 20, namely that construction of a wave attenuation structure in East Cote Blanch Bay would have limited effect on reducing storm surge.

Table 3-5. Iterations 1 and 2 Screening Rationale

Measure	Project Objectives			Criteria				Additional Screening Discussion	Decision to Move Forward or Screened
				Acceptability[1]	Completeness[2]	Effectiveness[3]	Efficiency[4]		
NO ACTION									
No Action	Low	Low	Low	Low	Low	Low	Low	Baseline condition – present and future.	Moved Forward
STRUCTURAL MEASURES									
Measure 1 State Levee Alignment A	High	High	High	Medium	High	High	Low	Extensive wetland impact and costly mitigation required. Additional cost associated with wetland mitigation was determined to make measure unlikely to economically justify. Measure is included in NFS Master Plan.	Screened From Further Consideration
Measure 2 State Levee Alignment B	High	High	High	High	High	High	High	Alignment is primarily on agricultural lands resulting in cropland impacts. This impact is not acceptable to the NFS and local land owners.	Moved Forward
Measure 3 Hwy 90 Alignment	High	High	High	Medium	High	High	Low	Alignment is parallel and directly south of Hwy 90. Hwy 90 would not be elevated as a result of this measure Levee construction would require a minimum of 20 highway crossings and gates to allow for traffic evacuation south of the alignment. Measure determined unlikely to justify due to additional costs of gates.	Screened From Further Consideration
Measure 4 Interior drainage pumps	Medium	Medium	Medium	High	Low	Medium	Medium	Pumps for interior drainage in the comprehensive levee system. Medium for effective and efficiency because it is a dependent measure. Measure is included in NFS Master Plan.	Moved Forward
Measures 5 and 6 Raise Existing Levees West of Berwick and Morgan City Back Levee	High	High	Medium	High	Medium	High	Medium	Increased height would increase levee base width and need to potential mitigate; majority of impacts would be short term temporary for construction. Wetland Impacts mitigation required. Medium and for completeness and efficiently because does not address full study area. Measure is	Moved Forward

								included in NFS Master Plan.	
Measures 7, 8, and 9 Ring Levees 1, 2, 3	High	High	Medium	Medium/Low	High	High	High	Only protects urban/industrial areas and not rural areas. Medium/Low on Acceptability is based on willingness to NFS cost share. Acceptability is on the low end of medium. Based on Southwest Costal project, public acceptability for ring levees is low.	Moved Forward
Measure 10 Sluice/Barge Gates At Key Bridges	**Medium**	**Medium**	**Medium**	**High**	**Low**	**Medium**	**Medium**	Levee alignment; medium for effective because it is a dependent measure with the purpose of reducing impacts to navigation, life risk & economic damages.	Moved Forward
Measure 12 Wave Attenuation Structures (directly off coast)	**Medium**	**Medium**	**Low**	**Medium**	**Medium**	**Medium**	**Medium**	Construction may impact oyster leases and wetlands. Dependent measure on justified levee measure. Screened following determining no structural plan was justified.	Screened From Further Consideration
Measure 13 Shoreline Protection Along Vermilion Bay	**Medium**	**Medium**	**Low**	**Medium**	**Medium**	**Medium**	**Medium**	Screened due to refined modeling of existing and FWOP conditions illustrating the erosional surface during a storm surge event is farther inland. Shoreline protection on the existing shoreline would have minimal benefits for reducing erosion. Measure is included in NFS Master Plan.	Screened From Further Consideration
Measure 18 Marsh Island Inlet Closure	**Low**	**Low**	**Low**	**Low**	**Low**	**Low**	**Low**	Distance from the main shoreline is too far; therefore, storm surge reduction is minimal. Inlet is 50-60 feet and 100 feet in certain locations would l kely be cost prohibitive.	Screened From Further Consideration
Measure 19 Wave Attenuation Structures (Marsh Island)*	**Low**	**Low**	**Low**	**Low**	**Medium**	**Low**	**Low**	Land may build near the barriers, increasing wetland habitat. Distance from the main shoreline is too far; therefore, storm surge reduction is minimal.	Screened From Further Consideration
NONSTRUCTURAL MEASURES									
Measure 11 Elevation and Floodproofing of structures within the 25 or 50, or 100 year floodplain	**High**	**High**	**Low**	**Medium**	**Medium**	**High**	**High**	Willing participation only. Measure is included in NFS Master Plan.	Moved Forward
Measure 14 Retention features to reduce size of pumps (reduction in size based on State plan recommendation)	**Medium**	**Medium**	**Medium**	**Low - Public and NFS**	**Medium**	**Medium**	**Medium**	In combination with additional measures, the effectiveness and efficiency weuld increase. Measure dependent upon other structural levee measures. Water retention features would be on the inside of levee. NFS would be responsible for LERRDs, NFS would need voluntary buyouts for getting land eminent domain would not be an option. Determined not technically feasibility due to hydraulic flow and design requirements resulting in need of large areas of land. Land availability to accomplish measure is not available within study area.	Screened From Further Consideration

Measure 14 var. Retention Features (To Replace Pumps)	Medium	Medium	Medium	Medium	Medium	Medium	Medium	In combination with additional measures, the effectiveness and efficiency would increase. Measure dependent upon other structural levee measures. Water retention features would be on the inside of levee. NFS would be responsible for LERRDs, NFS would need voluntary buyouts for getting land eminent domain would not be an option. Determined not technically feasibility due to hydraulic flow and design requirements resulting in need of large areas of land. Land availability to accomplish measure is not available within study area.	Screened From Further Consideration
Measures 15 Operational Optimization for Event Scenarios)	Medium	Medium	Low	Low	Low	Low	Low	In combination with additional measures, the effectiveness and efficiency would increase. Determined measure would not be effective as reducing impacts of storm surge. Current operations require pumping when water in channels reach 0 feet mean sea level. Changing pumping trigger points would result in higher pump maintenance and repair costs and labor costs with little to no effect on reducing surge impacts.	Screened From Further Consideration
Measure 16 Acquisition and Relocation of structures within the 25 year storm surge floodplain.	High	High	Low	Low	Medium	Medium	Low	Acquisition and demolition of structures within the 25 year storm surge floodplain would significantly reduce damages over the planning horizon. This option is likely cost prohibitive and may not be the cost effective option. Additionally, the acceptability of a large scale buy out is low for NFS and public. URA costs and identification of alternative housing is likely limiting. Measure is included in NFS Master Plan for willing sellers only.	Moved Forward
Measure 17 Marsh Creation (on Marsh Island)	Low	Low	Low	Low	Low	Low	Low	Distance from the main shoreline is too far; therefore, storm surge reduction is minimal. Marsh reduction of storm surge waves is not high. Measure is included in NFS Master Plan.	Screened From Further Consideration
Measure 20 Restore Rabbit Key and Duck Key*	Low	Low	Low	Low	Medium	Low	Low	Land may build near the barriers, increasing wetland habitat. Distance from the main shoreline is too far; therefore, storm surge reduction is minimal.	Screened From Further Consideration
Measure 21 Cote Blanche Freshwater Sedimentation Introduction*	Low	Low	Low	Medium	Low	Low	Low	The measure is a previous study performed by USACE. It was not implemented due to hazard magnetometer survey showing numerous abandoned pipelines. Features are primarily ecosystem restoration focus and due to low reoccurring economic losses in the area not likely to be cost justified.	Screened From Further Consideration

Measure 22 Reef Restoration*	Low	Low	Low	Low	Medium	Low	Low	Reef restoration may build near the barriers, increasing aquatic habitat. Distance from the main shoreline (~5 miles) is too far; therefore, storm surge reduction is minimal.	Screened From Further Consideration

[1] Acceptability is the workability and viability of the alternative plan with respect to acceptance by Federal and non-Federal entities and the public and compatibility with existing laws, regulations, and public policies.
[2] Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects.
[3] Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities.
[4] Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment
[5]-A score of "high" signifies the metric was met considerably.
[6]-A score of "medium" denotes the metric was met moderately.
[7]-A score of "low" indicates the metric was minimally met, if at all
*Indicates Natural and Nature Based

3.4.2 Third Planning Iteration Methods

To assess the benefits of remaining structural and nonstructural measures, the preventable physical damages to existing, residential, commercial, industrial, and public buildings and facilities were considered. There are other physical damages, and/or disruptions, associated with broadly dispersed physical infrastructure a natural resources, that may be integral to economic sectors, such as oil and gas production (e.g., pipelines production facilities, etc.) or agriculture (e.g., livestock field crops, etc.) However, because no assurance of reduction in loss of productivity can be determined through a dedicated, site specific application of the measures available these damages were not included.

Modeling was performed to determine where hurricane and storm surge damage potential exists in the study area. Figure 3-14 depicts structure locations (red dots) within the structure inventory that are included within the 100-year floodplain and thus, are at risk of hurricane or storm surge-induced flood damages. The structure inventory was not supplemented with additional residential and non-residential properties that are expected to be placed in service in the FWOP conditions. Floodplain regulations, mandated by the (NFIP), which is managed by FEMA, require that the FFE of any new structures be placed at or above the BFEs as indicated by the corresponding flood insurance rate map to be eligible to purchase national flood insurance. Therefore, while structures are expected to be placed into service in the future, their exposure to the risk of flooding from hurricane and storm surge is significantly less than many structures found under existing conditions.

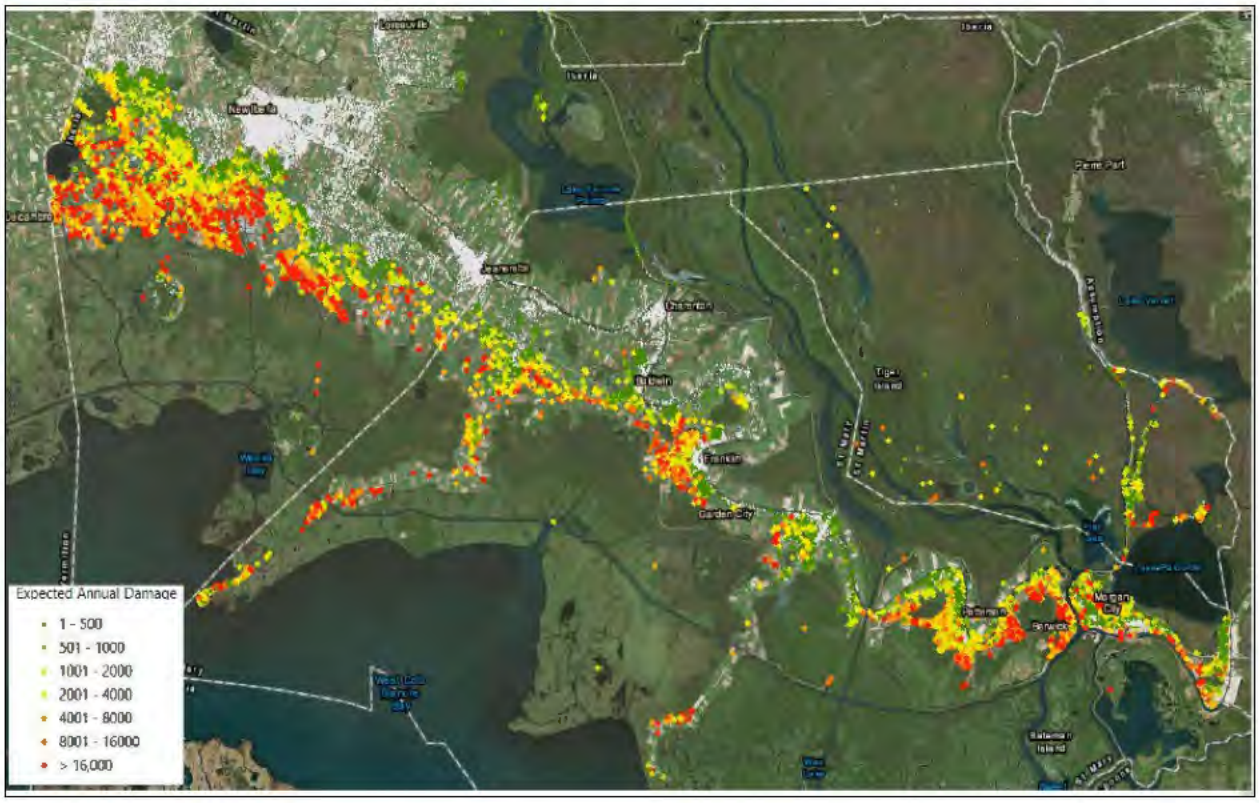


Figure 3 -14. Expected Annual Damages ($) of Residential and Non-Residential Structures in Study Area

The initial screening left ten measures that warranted additional evaluation. A full description of all measures and screening is available in Section 3.2.

The suite of measures carried through the third iteration include:

Measure 2 - Construct Comprehensive Levee System B with associated pumps and gates.
Measure 4 - (dependent)- Interior Drainage Pumps.
Measure 5 - Raise existing Morgan City Back levees (all segments).
Measure 6 - Raise existing Levees West of Berwick (all segments).
Measure 7 - Construction of new Ring Levee alignment 1 with associated pumps and gates.
Measure 8 - Construction of new Ring Levee alignment 2 with associated pumps and gates.
Measure 9 - Construction of new Ring Levee alignment 3 with associated pumps and gates.
Measure 10 - (dependent)- Sluice/barge gates at key bridges.
Measure 11 - variation A Elevate and floodproofing structures within the 25 year storm surge floodplain.

Measure 11 - variation B Elevate and floodproofing structures within the 50 year storm surge floodplain.
Measure 11- variation C Elevate and floodproofing structures within the 100 year storm surge floodplain.
Measure 16- Acquisition and relocation of structures within the 25 year Floodplain.

3.4.3 Evaluation Refinement of Structural Measures Carried to the 3rd Iteration

Flood frequency curves were used to obtain a flood depth. The Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA) Version 1.4.2 USACE-certified model was used to calculate the damages and benefits for measures based on damage curves. Finally, a maximum project supported was calculated for each of the measures carried through to the third iteration. CPRAB Report (2017) cost estimates were used for the comprehensive levee system B. The CPRAB Report cost estimates included total first costs, real estate, and wetland mitigation. Costs not included were future levee lifts, interest during construction, cultural resource surveys, and dngineering during & construction and supervisory & administration. Ring levee measures, developed by the USACE team and not included in the CPRAB report, used an average cost per mile of levee presented in the Arcadis Report multiplied by the linear length of levee. If the initial BCR had a value less than 1 and further refinements would likely not result in economic justification, the measure was screened from further consideration. BCR is calculated by dividing the total economic benefits by the total economic cost.

Due to the Port of Iberia being an economic hot spot, the USACE team determined evaluation of Ring Levee 1+2 and Ring levee 2 may result in a justified project if benefits were refined. Measure 8 (Ring Levee 2) and newly formulated Measure 8 variation (Ring Levee 1+2) were carried forward for further analysis. The third iteration resulted in the screening of Measure 7- Ring Levee 1 and Measure 9-Ring Levee 3 (Table 3-6).

Measure 6 - Levees West of Berwick evaluation included all segments. Due to low reoccurring economic damage and structures within the Levees West of Berwick a BCR greater than 1.0 was not reached. The USACE team determined Ex-1 segment, if evaluated separately, may produce a BCR greater than 1. Measure 6, Ex-1 segment of the Levees West of Berwick was carried forward for further evaluation.

Measure 5 - Morgan City Levees had a BCR greater than 1 and was carried forward for further evaluation.

Measure 2 - Comprehensive Levee Alignment B was analyzed first with and then without the Hwy 83 segment, resulting in a BCR below 1. As a result, Measure 2-Comprehensive Levee System B was screened from further analysis.

Table 3-6. Summary of Third Iteration Structural Measure Benefit Cost Ratio Assessment South Central Coast, LA

Measures	Total Cost	Average Annual Cost	Average Annual Benefits	BCR	Decision to Move Forward or Screened From Further Consideration
Measure 2: Comprehensive Levee B w/ Hwy 83	$1,412,900,000	$53,617,000	$26,990,000	0.5	Screened
Measure 1 Variation: Comprehensive Levee B w/out Hwy 83	$1,262,300,000	$47,902,000	$21,710,000	0.45	Screened
Measure 5: Levees West of Berwick	$136,227,000	$5,046,000	$3,247,000	0.64	EX-1 Carried forward
Measure 6: Morgan City Levee (Ex 16, 19, 20, 21, 22)	$85,089,000	$3,152,000	$3,002,000	0.95	Ex- 19 and 21 Carried forward
Measure 7: Ring Levee 1	$716,590,000	$26,543,000	$6,038,000	0.23	Screened
Measure 8: Ring Levee 2	$778,137,000	$28,823,000	$11,753,000	0.41	Carried forward*
Measure 9: Ring Levee 3	$313,000,000	$11,878,000	$2,080,000	0.18	Screened

Notes-Nonstructural measures (not listed), including acquisition, elevation and wet and dry floodproofing of structures, within the 25 year, 50 year or 100 year Floodplain were carried forward to the fourth iteration.

* Measures were carried forward to determine if design adjustments may result in a greater benefit cost ratio. Design adjustments are described in section 3.5.1 Refinement of Structural Measures.

**Measures 4 and 10 are not listed in the above table as they were identified as dependent measures and therefore do not have unique benefit cost ratios.

3.4.4 Evaluation Refinement of Nonstructural Measures Carried to the 3rd Iteration

Nonstructural measure were not evaluated in the third iteration. As a result, all of the nonstructural measures were carried forward into the fourth iteration for further analysis. Nonstructural measures include:

- Measure 11 var. a - Elevate and floodproofing structures within the 25 year storm surge floodplain,
- Measure 11 var. b - Elevate and floodproofing structures within the 50 year storm surge floodplain
- Measure 11 var. c - Elevate and floodproofing structures within the 100 year storm surge floodplain
- Measure 16 - Acquisition and relocation of structures within the 25 year Floodplain.

3.5 MEASURES CARRIED TO FOURTH PLANNING ITERATION

The suite of stand-alone measures evaluated in the fourth iteration include:

- Measure 5- Raise existing Morgan City Back levees (Ex 19 and Ex 21).
- Measure 6- Raise existing Levees West of Berwick Ex -1.
- Measure 8 var. - Construction of new Ring Levee alignment 1+2 with associated pumps and gates.
- Measure 8 - Construction of new Ring Levee alignment 2 with associated pumps and gates.
- Measure 11 var. a - Elevate and floodproofing structures within the 25-year storm surge floodplain.
- Measure 11 var. b- Elevate and floodproofing structures within the 50-year storm surge floodplain.
- Measure 11 var. c- Elevate and floodproofing structures within the 100-year storm surge floodplain.
- Measure 16 - Acquisition and relocation of structures within the 25-year storm surge Floodplain.

The following measures were carried forward as potential dependent measures in the fourth iteration:

- Measure 4 - Interior Drainage Pumps.
- Measure 10 - Sluice/barge gates at key bridges.

3.5.1 Refinement of the Structural Measures

The assessment of economic feasibility for four structural measures was completed on measures during the fourth iteration. Measure construction costs and associated assumptions were developed by USACE technical leads and are presented in Appendix B: Engineering. Results of the third iteration showed potential for justification if variations to structural measures were explored.

Morgan City back levees variations occurred after additional coordination confirmed St. Mary Levee and Drainage District completed levee elevations on subsegments resulting in a smaller and more refined locations for levee elevations. As a result, portions of levee segments Ex-19 and Ex-21 (Figure 3-6), known as Lakeside Gap and Youngs Road, are the only remaining segments within Morgan City back levee not completed to the 0.01 AEP storm surge risk reduction elevation. Youngs Road levee elevation would require raising approximately 3,054 linear feet.

The Lakeside Gap (Ex-21) would require an I-wall with barge gate to the east of Lakeside Subdivision. The I-wall was estimated at 2,143 feet long. An I-wall is a line of steel sheet piling similar to adjacent levee segments. The measure variation also includes replacing an existing barge gate on the eastern edge. Lastly, structural measures were determined to require compliance with higher safety criteria issued under the HSDRRS. Economic evaluations on structural measure under the fourth iteration are presented in Table 3-7 for standard structure safety criteria. Economic

assessments of all levee segments within levees west of Berwick, established the BCR was less than 1 during the third planning iteration. However, coordination with the NFS highlighted the importance of these reaches due to presence of critical infrastructure. The USACE team refined the levee west of Berwick measure to include levee subsegment Ex-1 only (Figure 3-6) as it had the highest probability of having a BCR of 1 or greater. The team repeated the evaluation comparing expected cost of damages over the 50-year planning period to the cost of constructing the levee elevation.

Costs in this iteration were based upon standard levee design (rather than HSDRRS design criteria) which was an intended underestimation. Fourth iteration BCR were the result of the overestimation of benefits and the underestimation of costs. The BCR (all of which were below 1) would have significantly decreased during refined evaluations as a result of design criteria and refined 50-year damage assumptions. Additionally, Measure 6-Morgan City back levees under standard design criteria cost only included closing existing unprotected sections. If HSDRRS criteria would be applied to the Morgan City back levees, the required HSDRRS criteria would require all of the Morgan City levees/floodwalls to be replaced with "T" walls (currently all floodwall/levees are "I" walls and do not have the higher stability required under the HSDRRS design criteria). This would result in significant cost increases without additional benefits being accumulated.

3.5.2 Economic Analysis of Structural Measures

A cost-benefit analysis was conducted to evaluate the economic feasibility of each of the structural measures. Expected annual benefits for 2025 and 2075 were converted to an equivalent annual value using the previous FY19 Federal interest rate of 2.75 percent, and a 50-year period of analysis. Total cost and estimated annual costs for the project measures included the construction costs, and future levee lifts, and estimated labor costs for risk reduction. Construction costs, along with the schedule of expenditures, were used to determine the interest during construction and gross investment cost at the end of the construction period. For the purposes of this study, construction was assumed to begin in 2025 and continue through 2027, with additional levee lifts (to maintain levee height due to sinking and subsidence) occuring three times post initial construction at 5-7 years, 15-20 years, and 30 years. The first levee lifts would be overbuilt and allowed to settle for several years before the latter levee lifts would be added for each alternative.

Mitigation costs due to unavoidable habitat impacts were calculated. The USFWS and USACE determined programmatic costs for proposed structural measures based upon visual inspection of habitat types potentially impacted along proposed structural measure alignments, professional judgment, and experience with similar hurricane storm surge risk reduction structural systems, and based on engineering assumptions of right-of-way footprints. Mitigation cost estimate details are described in Appendix A-1: Environmental Resources.

Benefits were calculated by estimating within the risk reduction area structural damages occurring at FFE. Damages were assumed to be reduced to zero as a result of the structural measure resulting in an over estimation of benefits.

Table 3-7 shows average annual costs, average annual benefits, and BCR for structural measures analyzed in the fourth array. Measures did not meet the BCR 1 threshold and were screened.

*Table 3-7. Economic Analysis of Structural Measures with 0.01 AEP Level Risk Reduction**

	Measure 6 Berwick Levee Raises	**Measure 8 Var. Ring Levees 1+2**	**Measure 8 Ring Levee 2**	**Measure 5a Morgan City Levee Raises**
Total Average Annual Benefits	$3,247,000	$17,792,000	$11,754,000	$3,002,000
Total Average Annual Cost	$5,046,000	$55,366,000	$28,823,000	$3,113,000
Net Benefits	($1,799,000)	($37,574,000)	($17,069,000)	($111,000)
BCR	**0.64**	**0.32**	**0.41**	**0.96**

*Measures 4 and 10 are not listed in the above table as they were identified as dependent measures and therefore do not have unique benefit cost ratios.

3.5.3 Economic Analysis of Floodproofing and Elevation Nonstructural Measures.

The total number of structures inventoried in 2019 (defined by the footprint of the 2075, 0.01 AEP floodplain) is approximately 62,000. The number of expected at-risk structures in the 0.01 AEP storm surge floodplain, in the base-year 2025, total approximately 8,875 residential, commercial, and public buildings (but excluding warehouses and industrial buildings). The number of expected at-risk structures in the 0.02 AEP storm surge floodplain, in the base-year 2025, total approximately 15,304 residential, commercial, and public buildings (but excluding warehouses and industrial buildings).

The 25- and 50-year floodplain had a BCR greater than 1. Final TSP selection was determined by comparing net benefits. Net benefits were calculated by subtracting the expected annual costs from expected annual benefits. The data extracted from the justified floodplains demonstrates the Federal interest in a 25-year floodplain nonstructural plan, provides definition of the potential magnitude of the plan, and identified this measure as the TSP for SCCL.

Table 3-8 shows the net benefits for the four nonstructural measures considered. The expected annual benefits for the 25-year floodplain nonstructural plan was estimated at $74.83 million assuming 100 percent property owner participation, the estimated cost for implementation is approximately $1.41 billion. The corresponding average annual cost is approximately $52.64 million; with net benefits of $22.19 million resulting in a BCR of 1.42.

Table 3-8. Economic Analysis of Nonstructural Measures with 0.01 AEP Level Risk Reduction

	0.04 AEP Elev/Floodproof	0.02 AEP Elev/Floodproof	0.01 AEP Elev/Floodproof	0.04 AEP Acquisitions
Total Average Annual Benefits	74,830,000	83,892,000	94,027,000	103,241,000
Total Average Annual Cost	52,639,000	70,982,000	117,079,000	111,488,000
Net Benefits	22,191,000	12,910,000	(23,052,000)	(8,247,000)
BCR	**1.42**	**1.18**	**0.80**	**0.93**

3.5.4 Economic Analysis of Acquisition and Relocation Measure Evaluation.

The USACE team completed an economic analysis of Measure 16 in the 4th iteration to assess the cost of acquisition and relocation of structures within the 25-year storm surge floodplain. The estimate of the cost of acquiring structures was computed once model execution was completed. Acquisition costs are based on the cost of acquiring the parcel of land, the structure(s) built on the land, an architectural survey, and miscellaneous costs associated with the acquisition process. The depreciated replacement value of the structure (excluding any contents) was used to represent the cost of the structure, which was previously described as being sourced from RSMeans square foot cost data. The acquisition cost was the cost of performing an architectural survey, which is associated with cultural resources concerns. Finally, the cost of demolition, deed changes, legal fees, and re-grading the surface were estimated and included as miscellaneous costs. These miscellaneous costs associated with acquisition were sourced from the 2010 USACE Cedar Rapids, Iowa Feasibility Report. The prices derived from the 2010 report were price indexed to 2019 price levels. Acquisition costs by structure were summed to yield an estimate of total structure acquisition cost.

Relocation costs were based on the cost of relocating a tenant residential occupant, as required per Uniform Relocation Assistance and Real Property Acquisition Act of 1970 (URA), that has been removed from the acquired parcel. Relocation costs include purchasing a suitably located piece of property commensurate with the acquired parcel and the costs associated with the URA. Costs associated with URA include assisting the occupant with moving costs and incidentals for residential structures and moving costs, searching expenses, and re-establishing costs for non-residential structures. The URA costs amount to $38,000 per residential structure and $50,000 per non-residential

structure. Relocation costs by structure were summed to yield an estimate of total structure relocation cost. The total acquisition and relocation costs were added together and applied on a per structure basis to estimate a cost of acquisition and relocation. Net benefits of Measure 16 are shown in Table 3-8.

Tables 3-7 and 3-8 show the average annual costs, average annual benefits, and BCR for each measure analyzed in the fourth array. As shown in the tables, the nonstructural 25-year and 50-year measure were the only measures with a BCR greater than 1.The highest net benefits were for the floodproofing and elevation of structures within the 25-year floodplain level of risk reduction. Net benefits are calculated by subtracting total economic cost from the total economic benefit of a measure.

3.6 SUMMARY OF PLAN FORMULATION

The USACE evaluated 22 structural, nonstructural, and natural/nature-based measures in varying level of detail to determine if they met project objectives, avoided project constraints, and if they maximized benefits. Through the iterative planning process, 20 of the measures were screened. At the end of the iteration 4, the USACE team determined that Measure 11 var. A (elevation and floodproofing structures within the 0.04 AEP storm surge floodplain) and Measure 11 var. B (elevation and floodproofing structures within the 0.02 storm surge floodplain) were the only measures economically justified with BCRs greater than 1, as shown on Table 3-8.

Measures 11 var. A and var. B were then identified as Alternative 1 and Alternative 2, respectively. Evaluation results and comparison of Alternatives 1, 2, and 3 (no action alternative) can be found in Section 4.

Following a critical analysis an evaluation of environmental effects, Alternative 1- elevation and floodproofing of structures within the 0.04 APE (25-year) storm surge floodplain was selected as the TSP, or in other words, the plan that was preliminarily recommended in the study's draft report.

IDENTIFIED ALTERNATIVES

Alternative 1: elevation and floodproofing structures within the 0.04 AEP storm surge floodplain, selected as the TSP

Alternative 2: elevation and floodproofing structures within the 0.02 AEP storm surge floodplain

Alternative 3: no action

Section 4
Evaluation and Comparison of Alternative Plans

4.1 Initial Evaluation Of Alternatives 1, 2, And 3

The USACE evaluated measures described in Section 3 and screened them based on their ability to meet the project objectives, avoid constraints, and to maximize benefits provided over the 50-year period of analysis from 2025 - 2075. Alternatives were developed with incrementally justified measures in accordance with ER 1105-2-100 and WRDA 1986. Justification criteria was a BCR of value greater than 1. Two nonstructural alternatives met threshold criteria at the TSP milestone and the completion of the draft report, they included:

Alternative 1- Floodproofing or elevation of 3,463 structures located within the 0.04 AEP (25-year floodplain) to 0.01 AEP future storm surge elevation. Alternative 1 would include the elevation of 2,629 residential structures and floodproofing of 834 and nonresidential structures.

Alternative 2- Floodproofing or elevation of 5,035 structures located within the 0.02 (50 year floodplain) to the 0.01 AEP future storm surge elevation. Alternative 2 would include elevation of 4,015 residential structures and floodproofing of 1,020 nonresidential structures.

The structure numbers for Alternatives 1 and 2 described above are from the analysis completed for draft report. Alternative 3, the No Action Alternative, was also evaluated. Alternative 3 represents the FWOP scenario.

Risk Reduction- The term 0.01 AEP level of risk reduction, refers to a level of reduced risk of hurricane and storm surge wave driven flooding that the project has a 1 percent chance of experiencing each year. The 0.01 AEP chance is based on the combined chances of a storm of a certain size and intensity following a certain track. Different combinations of size, intensity and track could result in a 0.01 probability of a surge event.

4.2 ECONOMIC EVALUATION OF FINAL ARRAY OF ALTERNATIVES

In the analysis completed at the time of the draft report (December 2019), Alternatives 1 and 2 were evaluated using the 0.04 and 0.02 AEP (25 and 50 year) floodplains within the study area as the aggregation method. Structures were included in the inventory if their FFE fell below the expected 2075, 0.01 AEP floodplain and evaluated for potential damages over the 50-year period of analysis (2025-2075). Benefits and costs were calculated on a floodplain by floodplain basis. Economic justification of each floodplain was determined by a comparison of average annual benefits to average annual costs.

The following assumptions were applied when evaluating floodproofing and elevations of structures within the 0.04 AEP and 0.02 AEP (25 and 50 year) floodplains:

- Elevation of residential structures to predicted 2075, 0.01 AEP BFE unless the required elevation is greater than a maximum of 13 feet above ground level*.
- Floodproofing of non-residential and public structures (excluding industrial buildings and warehouses) for flood depths not greater than 3 feet above the adjacent ground.

**Raising structures greater than 13 feet above ground level introduces damage risk from winds during tropical events as a new condition. This height generally serves as a differentiator for insurance rates for wind/hail coverage as well and is therefore used as the upper limit for elevating structures.*

As shown on Table 4-1, Alternative 1 has the greatest annual net benefits and was identified as the preliminary NED plan and carried into feasibility level of design.

Table 4-1. Economic Analysis of Alternatives with 0.01 AEP Level Risk Reduction

Alternatives	Total Costs (in Mil $)	Average Annual Costs (in Mil $)	Average Annual Benefits (in Mil $)	BCR	Net Benefits (in Mil $)
Alternative 1: Nonstructural at 25 year Floodplain (elevations and floodproofing)	$1,421.10	$52.64	$74.83	1.42	$22.19
Alternative 2: Nonstructural at 50 year Floodplain (elevations and floodproofing)	$1916.5	$70.98	$83.89	1.18	$12.9
Alternative 3: No Action	$0	$0	$0	$0	$0

Note: Cost and benefits presented in table are reflective of analysis at TSP.

4.3 EVALUATION AND COMPARISON USING THE FOUR ACCOUNTS

Plan formulation has been conducted with a focus on achieving the federal objective of water and related land resources project planning, which is to contribute to NED consistent with protecting the Nation's environment, pursuant to national environmental statues, applicable EOs, and other Federal planning requirements. Plan formulation considers all effects, beneficial or adverse, to each of the four evaluation accounts

identified in the *1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resource Implementation Studies* (P&G) which are NED, EQ, RED, and OSE.

NED: The benefits for each alternative plan were evaluated based on damages avoided using HEC-FDA. The HEC-FDA software developed by the USACE Hydrologic Engineering Center provides the capability to perform an integrated hydrologic engineering and economic analysis during the formulation and evaluation of RFM plans. HEC-FDA is designed to assist USACE study members in using risk analysis procedures for formulating and evaluating FRM measures (EM 1110-2-1619, ER 1105-2-101). Also, the sofware will assist USACE staff in analyzing the economics of FRM projects. HEC-FDA modeled benefits were used to compare across the final array of SCCL alternatives and select the NED plan. Alternative 1 had an additional $11.03 million worth of net benefits when compared to Alternative 2.

Regional Economic Development (RED): When the economic activity lost in the flooded region can be transferred to another area or region in the national economy, these losses cannot be included in the NED account. However, the impacts on the employment, income, and output of the regional economy are considered part of the RED account. The RED does not influence plan selection; however, the results can be useful for the sponsor and local stakeholders. Regional impacts are expected to include an increase in local, state, and national employment statistics as a result of the labor required for project construction. Local and regional sales industries including temporary housing, are expected to increase as a result of temporary laborers coming into the project area for project construction. RED account was assessed on the Alternative 1 results are provided in Section 7.1 of this Report.

Environmental Quality (EQ): An EQ analysis was conducted on the Recommended Plan, as the EQ account did not drive the plan selection for this project. Environmental benefits and impacts are discussed in detail as part of the NEPA evaluation in this report. Environmental consequences of alternatives for each key human and natural resource are described in Section 5 of this Report..

OSE: An OSE evaluation was completed on Alternatives 1 and 2 in order to communicate effectiveness of each alternative and ensure that social effects were considered as the alternatives were narrowed. OSE are discussed in detail as part of the NEPA evaluation in this report. Environmental consequences of the final alternative for each key human and natural resource are described in Section 5.

The four formulation criteria suggested by the P&G (completeness, effectiveness, efficiency, and acceptability) were also used to aide in the selection of the Recommended Plan. Descriptions of the P&G criteria are below. Table 4-2 evaluates the best buy alternatives using the P&G criteria.

- **Completeness** is the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planned effects.

• **Effectiveness** is the extent to which an alternative plan alleviates the specified problems and achieves the specified objectives.

• **Efficiency** is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and achieving the specified objectives.

• **Acceptability** refers to the workability and viability of the alternative with respect to acceptance by state and local entities and the public compatibility with existing laws.

Table 4-2. Alternatives Evaluated against P&G Criteria

	Principles and Guidelines Criteria			
	Completeness	**Effectiveness**	**Efficiency**	**Acceptability**
Alternative 1	Yes. The alternative includes all features needed to produce the stated effects.	Partially. The alternative optimizes risk reduction of structure damages associated with storm surge and wave action. Objective 3 was not achieved by this Alternative.	Yes. The alternative is a cost-effective means of providing a reduction of damages to structures within the 25-year floodplain associated with a 0.04 AEP storm surge event.	Yes. The alternative is viable and in accordance with state and local entities and the public compatibility with existing laws.
Alternative 2	Yes. The alternative includes all features needed to produce the stated effects.	Partially. The alternative alleviates risk of some structural damages associated with storm surge and wave action. Objective 3 was not achieved by this Alternative.	Partially. The alternative is a cost-effective means of providing a reduction of damages to structures within the 50-year floodplain associated with a 0.02 AEP storm surge event although less cost-effective than Alternative 1.	Yes. The alternative is viable and in accordance with state and local entities and the public compatibility with existing laws.
Alternative 3 (No Action)	Yes. No Action requires no additional features and assumes resource trends discussed in Section 2.	No. The alternative does not alleviate the problems identified and does not meet the objectives of the Project.	Yes. No money is expended, no benefits are gained, problems are not alleviated, and objectives are not met. No risk from storm surge and wave action would be reduced.	Yes. The alternative is viable and in accordance with state and local entities and the public compatibility with existing laws.

4.4 EVALUATION AND COMPARISON USING SCCL OBJECTIVES

Alternative 1, Alternative 2, and Alternative 3 No Action Alternative, were compared to SCCL objectives, presented and discussed in Section 1 of this report, to validate the selection of the TSP based on net benefit calculations (Table 4-3).

Table 4-3. Alternatives Comparison to SCCL Objectives

SCCL Study Objectives	Alternative 1 Nonstructural- 25 year Floodplain	Alternative 2 Nonstructural - 50 year Floodplain	Alternative 3- No Action
Objective 1. Reduce risk to life safety from hurricanes and storm surge within St. Martin, St. Mary, and Iberia parishes over the life of the project.	Alternative 1 is expected to reduce risk to life safety from storm surge flooding by elevating and floodproofing 3,463 structures. Structures include resident homes, businesses, and critical infrastructure.	Alternative 2 is expected to reduce risk to life safety from storm surge flooding by elevating and floodproofing 5,035 structures. Structures include resident homes, businesses, and critical infrastructure.	Alternative 3 would not reduce life safety risk.
Objective 2. Reduce economic loss/damages, as a result of hurricanes and storm surge to structures (i.e., residential, commercial, agricultural, and industrial) within the study area over the life of the project.	Alternative 1 is expected to prevent an estimated $74 million of annual damages. Floodproofing and elevation of critical infrastructure, such as emergency response equipment necessary for debris removal and post event response, Alternative 1 is expected to allow for reduction of highway closure time following an event. A reduction in closure time will result in less economic losses to the local economy.	Alternative 2 is expected to prevent an estimated $83 million of annual damages. However, through the floodproofing and elevation of critical infrastructure, Alternative 2 is expected to allow for reduction of highway closure time following an event. A reduction in closure time will result in less economic losses to the local economy.	Alternative 3 would not reduce economic loss/damages, as a result of hurricanes and storm surge to structures.
Objective 3. Reduce risk to and enhance reliability of primary evacuation route for study area residents and the greater City of New Orleans area (Hwy 90) over the period of analysis.	Alternative 1 is not directly anticipated to maintain Hwy 90 the key evacuation route.	Alternative 2 is not directly anticipated to maintain Hwy 90 the key evacuation route.	Alternative 3 would result in no change to the reliability of evacuation routes.

Note: Cost and benefits presented in table are reflective of analysis at TSP.

Alternatives 1 and 2 do not reduce flood depths on the HWY 90 evacuation route and does not provide any additional risk reduction for those evacuating. With that said, the average post-mitigation elevation of residential structures within the recommended NED plan is 13 feet above ground surface elevation. The future with project assumes elevated structures would meet structural stability requirements per local code. Parish emergency management plans and evacuation procedures, including trigger points, would be implemented across the geographic area and adherence to evacuation is not anticipated to change from the FWOP condition.

Alternative 3, the no action alternative, does not provide any benefits to the project area as it represents no federal action to reduce existing resource trends. Alternative 3 was not selected because it would not reduce coastal storm risk in the study area or increase sustainability and resiliency to storms for the affected communities. This alternative would cost $0. Risk from damages caused by hurricane, storm surge flooding, and wave action would not be reduced over the next 50 years. This alternative does not meet any of the project objectives.

Alternative 1 and 2 both had BCRs greater than 1 and met two of the three project objectives. The RP was determined by comparing net benefits. Net benefits were calculated by subtracting the expected annual costs from expected annual benefits. At the time of the completion of the draft report (December 2019), the expected annual benefits for Alternative 1 was estimated at $74.83 million assuming 100percent property owner participation, the estimated cost for implementation is approximately $1.42 billion. The corresponding average annual cost is approximately $52.63 million; with net benefits of $22.19 million resulting in a BCR of 1.42. As the net benefits of Alternative 1 exceeded the net benefits of Alternative 2 by $11 million, the USACE team identified Alternative 1 as the preliminary NED plan, as presented in the study's draft report. The following sections describe the optimization and refinement of Alternative 1 as the NED plan.

Section 5, *Environmental Consequences*, shows similar types of environmental impact when comparing action alternatives 1 and 2 since the primary different is an increase in number of structures due to increase in AEP across the two areas. The key difference between Alternative 1 and 2 is in residual risk, or risk remaining after complete project implementation.

4.5 FEASIBILITY LEVEL OF DESIGN - ALTERNATIVE 1

The planning process is a cycle of deliberation followed by analysis that ultimately leads to a recommended decision. It is naturally iterative, with opportunities to revise a decision and reduce remaining uncertainties throughout the study. SCCL planning iterations were a data driven process as such they differ from one another primarily with regard to the information that was utilized and the detail included in the measure evaluation.

Following the completion of the draft report, the USACE team continued refinement of Alternative 1 based on project components that could reduce uncertianity.The USACE team refined nonstructural measures and design assumptions to ensure Alternative 1 reduced economic damages and reasonably maximized net benefits.

Key refinements of Alternative 1 undertaken in feasibility level of design included:

- **Updated hydraulics:** average depth of flooding increased due to inclusion of wave action modeling and running future condition hydraulics through Flood Damage Assessment (FDA),
- **Updated structure inventory:** removed ~10 percent of structures after quality control on structure inventory data, refined foundation heights, uncertainty surrounding assumptions in FDA, and structure placement in the Port of Iberia,
- **Change in cost:** refined costs to be specific to occupancy type; and floodproofing method
- **Optimizations:** using max elevation for residential structures and wet-floodproofing measures for warehouses.
- **Design Refinements:** industrial structure types were determined not feasible for dry floodproofing measures due to hydrostatic pressure on metal prefabricated structure types.

The USACE team did not refine Alternative 2. Aggregation optimization was conducted after the completion of the draft report. The result of that optimization showed that net benefits were optimized in the 0.04 AEP aggregation. Since neither bracket (0.1 AEP or 0.02 AEP) of the optimization exceeded the net benefits of the 0.04 AEP aggregation, it was determined that the 0.04 AEP aggregation was optimized and would be utilized going forward. The large incremental drop in net benefits from the 0.04 AEP aggregation to either the 0.1 AEP or 0.02 AEP aggregation (as shown in Table 4-1), study team assumed that the results would change relative to each other by incorporating future condition hydraulics for Alternative 2.

4.5.1 Maximum Residential Elevation Optimization

During optimization of the Alternative 1, the USACE team found costs and damages did not reduce significantly when a residential home (single family or mobile home) was elevated to the 0.01 AEP and 0.004 AEP thresholds. The analysis also showed potential additional net benefits for higher structure elevation to mitigate a less frequent

future flood, such as the 0.002 AEP. As a result, USACE ran a maximum elevation mitigation optimization event to determine maximum residential structure elevation without moving into a higher cost bracket (see Appendix D- Economics for additional information).

The cost estimate table for elevating a residential structure increased at a very small incremental rate ($1/sq. ft.) to elevate a structure from the 8-12 foot range to the 13 foot range. Therefore, any structure currently being elevated to 8 feet could receive an additional 4-5 feet of mitigation for only an additional $1/sq. ft. The marginal benefits achieved by elevation surpassed the additional cost of elevating a structure to the next higher cost bracket (generally 13 feet above ground surface elevation). Due to current engineering constraints, elevation of a residential structure is limited at 13 feet above ground surface elevation, thus further optimization of elevation height is not possible. As a result of this analysis, the USACE team included maximum residential elevation as a component of Alternative 1. As a result of residential elevation height optimization, 99 percent of eligible residential homes in the study area would be elevated to the maximum 13 feet (the remainder would be elevated to 7 feet above ground surface elevation).

4.5.2 Dry Floodproofing - Technical Feasibility Refinement

During a flood event, unequal rates of rise and fall of water height on the inside and outside of a structure cause hydrostatic and hydrodynamic forces on the foundation wall Figure 4-1. During a flood event, unequal rates of rise and fall of water height on the inside and outside of a structure cause hydrostatic and hydrodynamic forces on the foundation wall as shown in Figure 4-1. For the average steel frame / steel corrugated siding warehouse structure within the study area, dry floodproofing presents numerous technical challenges and is not recommended without accounting for the structural vulnerabilities. The steel framing used in these industrial warehouse structures is not designed to withstand hydrostatic loading. In the event that an unreinforced steel frame warehouse becomes loaded, a partial structural collapse could occur in addition to water seeping through the steel frame into the interior of the building. The industrial warehouses are designed using continuous or floating slab concrete floors, meaning dry floodproofing could lead to uplift in the building or leakage through floor joints. The steel frame warehouse structures were not constructed to be water tight buildings or withstand hydraulic pressures, and would require, in some cases, significant external alterations. Therefore, dry floodproofing industrial structure types were determined to not be feasible for broad implementation due to the fact that site-by-site it would be either not technically feasible at some sites or it would be cost prohibitive at others due to the need for substantial external improvements.

Therefore, dry floodproofing industrial structure types were determined no longer technically feasible due to the structure type.

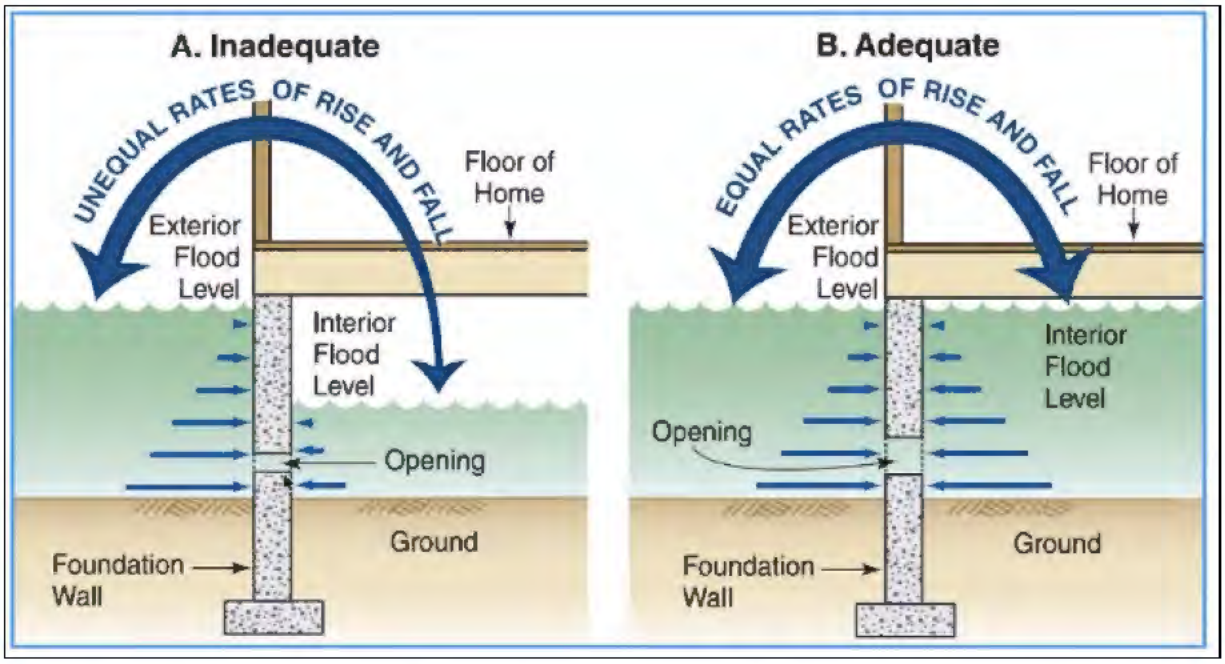


Figure 4-1. Wet floodproofing vents provide hydrostatic relief on foundation walls.

USACE determined the first step, to determine if other floodproofing methods could be technically feasible on industrial structures. USACE team reviewed locations of high industrial areas within the SCCL study area such as the Port of Iberia, Port of Morgan City, and Port of West St. Mary and other highly industrial areas. Existing industrial complexes and structure layouts were utilized to assess wet floodproofing methods effectiveness.

The USACE team evaluated wet floodproofing effectiveness by first identifying various wet floodproofing activities, then screening wet floodproofing activities based on applicability to industrial structures surveyed and lastly developing cost estimates for remaining activites. Details on wet floodproofing evaluation and screened are in described in Appendix L Wet Floodproofing Methodology Refinement.

The USACE team recalculated damages reduced and benefits achieved, Section 4.4 of this report describes the economic evaluation that includes wet floodproofing of the structure and it's contents. USACE assumed–wet floodproofing of warehouse structures could mitigate up to 12 feet of flooding to the structure envelope, and 6 feet to the structure's contents.

Damages increased significantly, when compared to estimates at TSP, due to the addition of wave action to existing still-water flood elevations that were added and refined to the hydraulic model post-TSP milestone. Wave action increased flood depths to above 3 feet during frequent flood events in high commercial/industrial areas, reducing the effectiveness and associated benefits of dry floodproofing.

4.6 ECONOMIC EVALUATION OF ALTERNATIVE 1 WITH CONTENT PROTECTION

The scope of Alternative 1 included nonstructural elevation, dry floodproofing and wet floodproofing measures on a total of 2,240 structures, across the 1,646 square miles of the 25 year floodplain of the SCCL study area. Coastal storm damages were estimated to be reduced to:

- 1,790 residential structures,
- 233 commercial structures,
- 32 public buildings (including 6 critical infrastructure structures), and
- 185 warehouses.

The reduction in damages was based on elevating residential structures and dry or wet floodproofing non-residential structures. The majority of residential structures (99 percent) were assumed to be elevated 13 feet above ground surface elevation, with the remaining residential structures elevated to 7 feet. Commercial structures were assumed to be dry floodproofed up to 3 feet above ground level. Warehouse structures were assumed wet floodproofed up to 12 feet, while the contents inside the structure were assumed to be wet floodproofed up to 6 feet. Wet Floodproofing measure design and cost refinements are dscribed in in Appendix L Wet Floodproofing Methodology Refinement.

A summary of benefits and damages reduced by the Alternative 1 is shown on Table 4-4. It is important to note that the economic analysis presented in Table 4-4 for the Alternative 1 presents data completed using refined assessments in feasibility level of design and cannot be directly compared to the economic analysis presented in Section 4.1.

Additional information on refinements made during feasibility level of design can be found in Section 3 and in the Engineering, Hydraulics and Hydrology, and Economics Appendices (Appendices B, C, and D, respectively).

Table 4-4. Economic Analysis of Alternative 1

Alternative	Total Costs (in Mil $)	Average Annual Costs (in Mil $)	Average Annual Benefits (in Mil $)	Benefit/ Cost Ratio	Net Benefits (in Mil $)
Alternative 1 (Refined): Nonstructural at 25 year Floodplain (elevation, wet, and dry floodproofing)	$1095	$37.4	$87.2	2.3	$49.8

Note- Economic analysis presented above includes wet floodproofing including design elements flood resistant materials and protection of content measures. Figures are rounded to the nearest hundred thousand.

Life cycle cost estimates were provided for the nonstructural measures in FY 22 price levels. The initial construction costs and a schedule of expenditures were used to

determine the interest during construction and gross investment cost at the end of the installation period (2025). The FY22 Federal interest rate of 2.25 percent was used to discount the costs to the base year and then amortize the costs over the 50-year period of analysis.

Ninety-nine percent of residential structures are recommended to be elevated to a maximum elevation of 13 feet above ground surface elevation. It is therefore assumed, pending advancements in engineering design capabilities for residential home elevations, no future elevation would be necessary or possible.

Net benefits were calculated by subtracting the annual costs from the expected annual benefits. Damages reduced begin to diminish as the frequency of flood event decreases for commercial and public structures due to the dry floodproofing method applied. Dry floodproofing is only effective up to 3 feet, so higher depths from lower frequency flood events lead to the effectiveness of floodproofing to be exceeded during approximately the 0.01 AEP flood event. Alternative 1 did not reduce any damages to vehicles. Alternative 1 would reduce flood damage for a total of 2,240 structures, of which 1,790 are residential and 450 are non-residential.

Owner/occupants of properties which would be voluntarily elevated would not be eligible for URA benefits. However, tenants of these structures may be eligible. Allowable relocation assistance funds for displaced tenants was estimated in accordance with P.L 91-646, URA and Real Property Acquisition Act of 1970 . Relocation assistance for qualifying tenants who occupy structures to be elevated may include reimbursement of moving costs, replacement housing payments, rental assistance payments, as well as advisory services to assist with locating replacement housing.

Costs associated with cultural resource preservation were estimated from USACE contracted cultural resource survey and mitigation costs.

OMRR&R costs associated with wet floodproofing measures assumed painting of building envelope once in the 50-year planning horizon and inspections by the NFS, rehabilitation of hoist once in the 50-year period, painting, cleaning, securing shelving, and annual hoist maintenance. OMRR&R for estimates were based on operation and maintenance logs and frequency associated with hoist structures on existing FRM projects with USACE. Structures are located in similar coastal environments and would experience similar frequency of use. Estimated OMRR&R associated with Alternative 1 are provided in Table 4-5.

Table 4-5. Alternative 1 OMRR&R Cost Summary

	Hours	Cost per Hour	Cost per Year	Cost over project life
O&M for Hoist	24 per year	$30.0	$720	$36,000
O&M for Shelving System	12 per year	$30.0	$360	$18,000
Paint and Lubricant (cost based on % of labor)	N/A	N/A	$220	$11,000
NFS/CPRA inspections - Allow 1 day (8 hrs) at $150/hr including transportation.	8	$150.00	$1,200	$60,000
Annual Cost Per Structure			$2,500	125,000
Rehabilitation of Hoist (1x within 50 years)	N/A	N/A	N/A	$337,500

*OMRR&R costs and frequencies were informed by operation and maintenance logs for similar structures on existing FRM projects with the CEMVN AOR.

*Total cost of OMRR&R excludes the present value analysis required to determine average annual cost.

Tables 4-6 shows the average annual costs, average annual benefits, and BCR Alternative 1 with wet floodproofing measures mitigating damages to structure and contents.

Table 4-6. Economic Analysis of Alternative 1 (Damages Reduced)

Category	Economic Evaluation
Structure Elevation Cost	373,096,000
Dry Floodproofing Cost	35,281,000
Wet Floodproofing Cost	210,819,000
Total	619,196,000
Contingency (31.7%)	196,285,000
Cultural Resource Preservation	14,723,000
Real Estate	41,145,000
Planning, Engineering, and Design (5%)	142,367,000
Construction Management (2%)	79,093,000
Interest During Construction	2,427,000
Project First Cost	**1,095,236,000**
Annual Operations and Maintenance	688,000
Total Average Annual Benefits	87,186,000
Total Average Annual Cost	37,399,000
Net Benefits	49,787,000
BCR	**2.33**

* Costs are based on FY 22 interest rate and rounded to the nearest thousand

* OMRR&R costs shown here include present value analysis and are annualized over the 50 year period of analysis.

Feasibility level of design on Alternative 1, included optimization to residential structure elevations and investigation of wet floodproofing methods, including content protection measures. Higher net benefits and lower residual risks were achieved when compared to the TSP performance. Floodproofing methods were incrementally justified, results are illustrated in Table 4-7.

Table 4-7. Alternative 1 With Content Protection Measures- Incremental Justification at 2.25%

Construction Category	Mitigation Type	Average Annual Costs	Equivalent Annual Damages	BCR
Residential	Elevation	22,120,000	24,042,000	1.09
Commerical & Public	Dry Floodproofing	2,092,000	11,231,000	5.37
Industrial	Wet Floodproofing	13,187,000	51,913,000	3.94
Total		37,399,000	87,186,000	2.33

4.7 IDENTIFICATION OF THE NED PLAN

Following economic optimization and refinement, content protection measures were determined to not be implementable under existing USACE programs and authorities. Therefore to achieve benefits associated with the Alternative 1 described in this section additional actions will need to be taken by NFS, state, local, agencies or by structure owners. Preliminary costs and benefits associated with content damage reduction measures are provided for consideration to planning partners and further detailed in Appendix J Wet Floodproofing Methodology Refinement.

ER 1105-2-100 states that when selecting a plan, a single alternative will be selected for recommendedation from among all those that have been considered. The recommended plan must be shown to be preferable to taking no action or implementing any of the other alternatives. The criteria for selecting the recommended plan for a coastal storm risk project that is appropriate for USACE participation is based on project outputs for NED plan. The NED plan is the alternative that reasonably maximizes net economic benefits consistent with protecting the Nation's environmental. While the Alternative 1, with content protection measures, had higher net benefits and further reduces residual risks it was not identified as the NED plan because it includes measures that can not be implemented under existing USACE authories. Therefore the NED plan excludes the content protection measures as part of the wet floodproofing of the 185 warehouses.

Table 4-8 provides a comparison of Alternative 1 with content protection measures included and NED plan across key cost, benefit, and performance metrics. Since the modification to the Alternative 1 was minor it was determined that beside the changes identified in Table 4-8, no other differences in the criterion displayed in Section 5 and 6 were discernable.

Table 4-8. Comparison Of Costs, Benefits, And Alternative Performance

Key Factor	Alternative 1	Recommended Plan
Costs		
Project First Cost	$ 1,095,236,000	$914,769,000
Total Project Cost (Fully Funded)	$1,598,075,000	$1,334,413,000
O&M Costs	$688,000	$386,000
Average Annual Costs	$37,399,000	$31,048,000
Average Annual Damages (Benefits)	$87,186,000	$45,130,000
Average Annual Net Benefits	$49,787,000	$14,082,000
Benefit to Cost Ratio (BCR)	2.33	1.45
Life Safety Risk - OSE		
Tolerability	No Change between Alternative 1 & Recommended Plan Life safety risk reduction is a minor positive impacts as a result of structure elevation. Life safety risk reduction is specific to residents who shelter in place and during events not requiring evacuation.	No Change between Alternative 1 & Recommended Plan Life safety risk reduction is a minor positive impacts as a result of structure elevation. Life safety risk reduction is specific to residents who shelter in place and during events not requiring evacuation.
Environmental Impacts- EQ		
Mitigation Costs	$0	$0
Residual Risk		
Average Annual Economic Damages (Study Area)	$260,944,000	$260,944,000
Average Annual Economic Damages (Project Area)	$158,360,000	$158,360,000
Critical Infrastructure	6	6
Percent Reduction of Damages in Study Area (2025)	41% Reduction	17% Reduction
Percent Reduction of Damages in Aggregated Area (2025)	66% Reduction	27% Reduction

*Note-Refine Alternative 1 cost figures are based on August 2021 escalation rates. Recommended Plan cost figures are based on March 2022 escalation rates.

*Note-Content damages benefits benefit are associated with a reduction of NFIP insurance claims projected over the 50 year period of analysis.

Section 5
Environmental Consequences

5.1 INTRODUCTION

In accordance with the NEPA, this section includes the scientific and analytic basis for comparison of the considered alternatives identified in Section 4, *Evaluation and Comparison of Alternative Plans*, as well as the No Action Alternative. The discussion includes the environmental impacts of the considered alternatives, any adverse environmental effects which cannot be avoided, the cumulative effects of proposed actions, the relationship between short-term uses and long-term productivity, and any irreversible or irretrievable commitments of resources that would be involved in the proposed actions should one be implemented.

This Section assesses each alternative's potential environmental impact on those resources identified in Section 2, Affected Environment. The resources described in this Section are those recognized as significant by laws, EOs, regulations, and other standards of National, state, or regional agencies and organizations; technical and scientific agencies, groups, or individuals; and the general public.

Definitions

Pursuant to NEPA, this section addresses the impacts in proportion to their significance (40 CFR § 1502[b]). Significance requires consideration of context and intensity (40 CFR § 1508.27). The depth of analysis of the alternatives corresponds to the scope and magnitude of the potential environmental impact. Impacts are considered to be any adverse or beneficial consequences on the human or natural environment caused by the implementation of an action and include any irreversible or irretrievable commitments of resources should the action be implemented.

In addition, impacts on the human and natural environment are direct or indirect. Direct impacts are those caused by the action and occur at the same time and place (40 CFR § 150.8.8(a)). Indirect impacts are those caused by the action and are later in time or further removed in distance but are still reasonably foreseeable (40 CFR § 1508.8(b)).

The USACE uses the terms "adverse" and "significant" in this document to describe potential impacts from the proposed alternatives. These words are defined as:

- Adverse – a negative impact on the human, natural, and/or physical environment.
- Significant – a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the proposed action, including, land, air, water, minerals, flora, fauna, ambient noise, and/or objects of historic or aesthetic value.

For the purpose of this analysis, the magnitude of impacts are classified as negligible, minor, moderate, or major and defined as:

- Negligible: A resource was not affected or the effects were at or below the level of detection; changes were not of any measurable or perceptible consequence.
- Minor: Effects on a resource were detectable, although the effects were localized, small, and of little consequence to the sustainability of the resource.
- Moderate: Effects on a resource were readily detectable, long-term, localized, and measurable.
- Major: Effects on a resource were obvious, long-term, and had potential consequences on a regional scale.

The duration of the effects in this analysis is defined as:

- Short term — when effects last less than one year.
- Long term — effects that last longer than one year.
- No duration — no effect.

Summary of environmental consequences by each alternative.

This section describes the environmental consequences associated with implementing the alternatives for the nonstructural hurricane storm surge damage risk reduction NED plan.

The Action Alternatives carried forward, as described in Sections 3 and 4 are nonstructural meeting a positive cost benefit ratio. In Section 4, the USACE compares **Alternative 1-** 25-year floodplain (refinement of Alternative 1, the NED Plan), and **Alternative 2-** 50-year floodplain, to **Alternative 3-** the No Acton Alternative.

These alternatives are:

Alternative 1 - Nonstructural Measures within the 25-year floodplain. Nonstructural measures differ from structural measures since they focus on reducing consequences of flooding instead of focusing on reducing the probability of flooding. Nonstructural measures include elevating (or raising) existing residential structures, dry floodproofing commercial and public buildings and wet floodproofing warehouses. Additionally, evacuation planning is part of this measure. Alternative 1 measures include:

- Elevation of eligible residential structures. Elevation of up to 1,798 residential structures to an elevation no greater than 13 feet above ground surface elevation. Elevation of the entire structure or the habitable area of a structure would allow floodwaters to flow and recede underneath.
- Dry floodproofing of eligible structures. Dry floodproofing 265 nonresidential structures to reduce flood risk. Dry floodproofing would ensure that floodwaters cannot get inside by making walls, doors, windows, and other openings impermeable to water penetration up to 3 feet above grade.

Wet floodproofing of warehouses or other eligible industrial structures. Floodproofing 185 structures so the structure is wet flood proofed up to 12 feet.Wet floodproofing would allow floodwaters to enter enclosed areas through vents while also protecting the structural stability of a warehouse.

Alternative 2 - Nonstructural Measures within the 50-year floodplain. The 50 year floodplain includes the 25 year floodplain and expands to a larger area inland. There are 5,035 total structures; 4,015 being residential, and 1,020 nonresidential. The eligibility and nonstructural measures would be the same as the 25 year floodplain alternative, but over a larger area and involve more structures. Likewise, the USACE assumed the related environmental impacts would be commensurate to the floodplain's area, resources, land use and human activity.

Alternative 3 - The No Action Alternative. The No Action Alternative, as required by NEPA, is the baseline to compare the proposed alternatives. Under the No Action Alternative, environmental consequences will still occur because the existing environment is not static. The USACE evaluated the difference between the impacts of taking an action and no action to establish a benchmark and enable decision makers to compare the magnitude of the environmental effects of implementing an action alternative.

5.2 RESOURCES

5.2.1 Water Environment (Hydrology and Hydraulics)

This discussion combines Riverine, Storm Surge, RSLR, and Floodplain Resources, and includes potential impacts to water stage duration and frequency, and RSLR. Appendix C: Hydraulics, Hydrology, and Climate Preparedness and Resiliency discusses in detail the USACE's assumptions for the action alternatives and the No Action Alternative.

Alternative 1 – 25-year Floodplain. The total level of impact would be relatively minor and would be dependent on the combination of nonstructural methods used and the participation rate in the project. Potential direct and indirect impacts to flow and water depend on the method used.

For example:

- Raising structures with pilings could increase storage capacity and lower surge elevations for those structures not elevated.
- Localized storm surge risk reduction measures could decrease storage capacity and raise the surge elevations for those nearby structures that would not be elevated.
- Raising structures with a cinderblock chain wall would have similar impacts as existing conditions on storage capacity and surge elevations since it would mimic existing conditions of the structure.

There are no direct or indirect impacts from structure elevation or floodproofing on the natural or regulated floodplains. The nonstructural alternative's impact may affect activities and existing structures in the floodplain, but the physical character of the floodplain would not change.

Alternative - 2 50-year Floodplain. The USACE anticipates this alternative would have similar impacts to the 25-year alternative, only on a larger scale. There would be minimal impacts to the water stage, duration and RSLR.

Alternative 3 - No Action. The probability and extent of flooding are increasing throughout the floodplains in the study area due to RSLR and changes in precipitation due to climate change. FEMA may change the regulatory floodplains based on changes in flood frequency.

Riverine, storm surge, RSLR, and floodplain resources will be prone to any change in temperature resulting from climate change. This area's low lying land will be subject to increased flood events, major storms and land loss.

5.2.3 Navigation and Public Infrastructure

This discussion includes potential impacts to:

- GIWW
- Existing Flood Risk Reduction features (levees, gates, etc.).
- Ports, such as the Port of Iberia and Port of West St. Mary
- Highways, city streets and rural roads (possibly used as evacuation routes)

Alternative 1 – 25-year Floodplain. There would likely be no direct or indirect impacts from structure elevation or floodproofing on existing navigation or flood risk reduction structures.

Alternative 2 – 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative.

Alternative 3 – No-Action. Navigation and public infrastructure features in the study area will continue to provide service throughout the study period. These features will undergo routine maintenance and perhaps major rehabilitation.

As the area's population changes, the USACE assumes the public infrastructure will change to meet its future demand.

5.2.4 Socio-Economics (The Human Environment)

The USACE would implement either nonstructural alternative on an entirely voluntary basis, lessening the potential adverse impacts on the human environment. Please note the **Alternative 3 No Action** description is found at the end of this Socioeconomic Section.

5.2.4.1. Population and Housing

Alternative 1 – 25-year Floodplain. There would be negligible direct impacts to population and housing (number of households) under the nonstructural plan. Indirect impacts may include an increase in the need for temporary housing while a home is being elevated. Indirect impacts would be short term, with no lasting effects.

Alternative 2 – 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative; however, larger in scale because this alternative would cover a larger area and involve more structures.

5.2.4.2. Employment, Business, and Industrial Activity

Alternative 1 – 25-year Floodplain. There would be negligible direct impacts to overall employment, business, and industrial activity associated with the floodproofing of businesses and the construction of wetproofing measures in the nonstructural plan. If and when commercial structures are flood proofed, there may be a temporary impact to businesses as they could potentially either shut down or relocate temporarily while the measure is being applied, leading to a temporary loss of revenue, change in business clients to other more available businesses, as well as a temporary loss of wages to employees. Indirect impacts include additional employment needed to complete any construction. The construction of localized wetproofing measures around warehouses could temporarily and intermittently impede access to the warehouses during construction and cause drainage issues for adjacent areas and structures. For the study area as a whole, temporary relocations would likely take place within the overall study area during implementation of the nonstructural measures, resulting in little if any change in hotel/motel income.

Inclusion of the wet floodproofing of warehouses would provide positive benefits to businesses within the Port of Iberia by reducing facility damages and recovery and clean up down time after a storm event. Return to full employment and productivity would take less time as well.

Alternative 2 – 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative; however, larger in scale because this alternative would cover a larger area and involve more structures.

5.2.4.3. Public Facilities and Services.

Alternative 1 – 25-year Floodplain. There would be temporary direct impacts associated with floodproofing to public facilities in the area. Potential impacts would be the interruption and temporary unavailability of public services if these facilities are forced to close or are relocated to temporary locations during implementation of the nonstructural risk reduction measures.

Floodproofing public facilities and services would result in positive indirect benefits because facilities would experience reduced damages and faster recovery following storm events, allowing the public to more quickly access important services and returning employees to work.

Alternative 2 – 50-year Floodplain. Impacts would be the same as the 25 year floodplain alternative; however, larger in scale because this alternative would cover a larger area and involve more structures.

5.2.4.4. Transportation

Alternative 1 – 25-year Floodplain. Direct impacts associated with the NED plan for transportation would include temporary and intermittent delays, disruption of traffic movement, congestion of roads, and re-routing of vehicles and pedestrians during the construction of the various risk reduction measures. Local parking access for businesses could also be affected by construction vehicles and crews and construction of the localized wet flood proofing measures around the warehouses.

Indirect impacts would include the additional wear and tear on roads, especially local roads, caused by large trucks transporting construction materials including borrow material transported for construction of local risk reduction measures at warehouses, as well as reduced parking. There would also be greater noise and dust generated by construction vehicles. However, best construction management practices limit dust emissions and to ensure the safety of construction workers, residents, and employees during construction of the nonstructural measures. There could be minor indirect short term impact to transportation due to construction related activities related to both structural elevations and commercial /warehouse floodproofing measures. These impacts would vary depending on the number and location of structures undergoing improvements at a given time and the timing and duration of the construction-related activities. There would be no long-term impacts to transportation resources.

Alternative 2 - 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative; however, larger in scale because this alternative would cover a larger area and involve more structures.

5.2.4.5. Airports

Alternative 1- 25-year Floodplain. The Harry P. Williams Memorial Airport is the only airport located in the 25 year floodplain. Direct impacts associated with the NED plan for this airport and airport operations would include temporary and intermittent delays, disruption of traffic movement, congestion of roads, and re-routing of vehicles and pedestrians during the construction of the various risk reduction measures. Local airport access could also be affected by construction vehicles and crews and construction of the localized flood proofing measures around the peripheral buildings and accoutrements.

Indirect impacts would include the additional wear and tear on roads, especially local roads, caused by large trucks transporting construction materials including borrow material transported for construction of local flood proofing measures at warehouses, as well as reduced parking. There would also be greater noise and dust generated by construction vehicles. However, best construction management practices limit dust emissions and to ensure the safety of construction workers, residents, and employees during construction of the nonstructural measures. There could be minor indirect short term impacts to airports due to construction related activities related to both structural elevations and hanger or other building floodproofing measures. These impacts would vary depending on the number and location of structures undergoing improvements at a given time and the timing and duration of the construction-related activities. There would be no long term impacts to airport resources. The Airport did not provide any comments concerning the November 2019 draft IFR and EIS.

None of the proposed activities would promote additional use of the air space by birds at or near airports. Therefore, there would be no additional air strike issues with feeding, flying, or loafing wildlife.

Alternative 2- 50-year Floodplain. Impacts would be the same as the 25 year floodplain alternative. There are no other airports in the 50-year floodplain.

5.2.4.6. Community and Regional Growth (Income)

Alternative 1 – 25-year Floodplain. Direct impacts would include a temporary monetary stimulus to the region due to spending associated with the construction activities in the area. This stimulus would be an increase in the region's income for as long as the spending continued. Overall, region changes to people's income should not change appreciable. For the study area as a whole, temporary relocations would likely take place within the overall study area during implementation of the nonstructural measures, resulting in little if any change.

Indirect impacts would include reduced risk of hurricane storm surge-related damages for those low-lying structures located in the 25-year floodplain thus reducing overall social vulnerability and preserving growth opportunities for communities in the region and enhancing the potential for long-term growth and sustainability.

Alternative 2 – 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative; however, larger in scale because this alternative would cover a larger area and involve more structures.

5.2.4.7. Tax Revenue and Property Values

Alternative 1 – 25-year Floodplain. Parish sales tax revenue would likely increase during the implementation of nonstructural measures. Construction activities associated with the NED plan would provide jobs and could increase the level of spending, labor, and capital expenditures in the area. Property values should trend upward based on the reduction of flood damage and less dependency on flood insurance. The USACE does not anticipate any indirect impacts to tax revenue or property values.

Alternative 2 – 50-year Floodplain Alternative. Impacts would be the same as the 25 year floodplain alternative; however, larger in scale because this alternative would cover a larger area and involve more structures.

5.2.4.8. Community Cohesion

Alternative 1 – 25-year Floodplain. Direct impacts that would temporarily disrupt community cohesion include the noise and construction activity dust, the temporary displacement and relocation of residents during construction, and disruption of businesses and public services during construction. Furthermore, non-residential structures serving as meeting places for the community could become temporarily unavailable during project implementation.

Indirect beneficial impacts for the nonstructural plan would include reduced risk of hurricane storm surge-related damages for lower-lying structures within communities, thus preserving community cohesion in the region. Other indirect impacts include improvements to pedestrian and persons with disabilities access not only to homes, but also to community facilities benefiting from nonstructural measures.

Alternative 2 - 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative; however, larger in scale because this alternative would cover a larger area and involve more structures.

5.2.4.9. Recreation Resources.

Alternative 1- 25-year Floodplain. The nonstructural features would have no impact to recreational resources depending on the methods used. A direct impact from floodproofing park buildings would be recreational use of the buildings would be temporarily unavailable during floodproofing work. An indirect impact of elevating structures would be that building costs of future recreational camps could result in fewer camps being constructed.

Alternative 2 – 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative; however, larger in scale because this alternative would cover a larger area and involve more structures.

5.2.4.10. Other Social Effects (OSE)

A summary of OSE is presented in Table 5-1. Other Social Effects include reduction in risks associated with damages from hurricane storm surge events to housing units, public facilities, and commercial structures located within areas where the NED plan is implemented, as well as improvement in the health and safety of those residents living within these and surrounding areas. Depending on participation rates, the overall social vulnerability of all three parishes could be reduced, and thus, the potential for long-term growth and sustainability could be enhanced. These areas could be at a reduced risk of incurring costs associated with clean-up, debris removal, and building and infrastructure repair associated with damage from a hurricane storm surge event.

Table 5-1. Other Social Effects Evaluation

Social Factors and Metrics	Alternative 1 - 25 year Floodplain. Nonstructural Measures	Alternative 2 - 50 year Floodplain. Nonstructural Measures	No Action
	DL / FE	DL / FE	DL / FE
Physical Health/Safety	1/2	1/2	-1/-2
Regional Healthcare	1/2	1/2	0/-2
Employment Opportunities	1/3	1/3	-1/-3
Community Cohesion	1/2	1/2	-1/-1
Vulnerable Groups	1/1	1/1	-1/-2
Residents of Study Area	1/1	1/1	-1/-2
Recreational Activities	1/2	1/2	-1/-2
	Impacts are in comparison to the Without Project Condition DL = impacts to daily life when there is no storm/flooding FE = impacts during a storm/flood event Scores range from -3 (significant negative impact) to +3 (significant positive impact)		

Alternative 1 – 25-year Floodplain.Under the NED plan measures, tenants would be eligible for certain temporary relocation assistance benefits. While structure owners would not be responsible for eligible costs associated with the nonstructural measures, (see Appendix K - Implementation Plan for a description of eligible costs), they would be responsible for ineligible costs associated with the structure elevation, including temporary relocation costs and any costs for moving out of the eligible structure during construction of the nonstructural measure. The ability of lower income groups to participate in the project could be impacted by these out of pocket expenses including the costs associated with temporary relocation during structure elevation, and any additional costs that would be required in order to meet the project eligibility criteria, (i.e., costs associated with any necessary structural repair or asbestos abatement). This could potentially offset, to some degree, the reduction in overall social vulnerability at least in lower income communities.

Alternative 2 – 50-year Floodplain. Nonstructural measures in the 50 year alternative area would have similar OSE benefits as in the 25-year floodplain. However, benefits would be reduced because of the increased frequency of storms in the 25 year floodplain and flooding covers a larger area.

Alternative 3 - No Action. the USACE assumed the socioeconomic indicators would remain stable over the study period. Population trends will shift to a more urban setting and occupations would have similar shifts from agriculture to urban jobs.

- **Population and Housing** – Future population and housing trends are anticipated to go down (Table 2-3) (U.S. Census Bureau data). Unmitigated storm damage will reduce home values and the resiliency to live in the study area.
- **Employment, Business, and Industrial Activity** - Nonfarm employment (trade, transportation, utilities, and government, local government, and office using industries) is expected to decrease by the year 2040 (U.S. Census Bureau, 2018).
- **Public Facilities and Services** – Public facilities such as transportation corridors, airports, healthcare facilities and other public services like fire and police protection should remain stable for the next 50 years.
- **Community and Regional Growth (Income)** - Per capita growth in income through the year 2040 is expected to rise (Table 2-5) (U.S. Census Bureau, 2018).
- **Community Cohesion** – The study area's strong creole and Cajun culture will remain strong for the next 50-years. However, community cohesion will be strained as population growth declines in the study area. One reason for the population decline is the impact from storms and storm surge.
- **Recreation Resources** - Recreation would remain an important resource and should remain stable in opportunities and participation. Recreational opportunities are anticipated to continue into the future without a change in pattern or use. Storm surge may either temporarily disrupt some types of passive recreation or permanently reduce other activities due to the cost of repeated repairs

5.2.5 Environmental Justice

Alternative 1 - 25-year Floodplain The voluntary nonstructural plan for SCCL may have some direct impacts on EJ communities but these impacts are not disproportionately high and adverse. All structures within the 25-year flood zone are located in economically justified reaches and would be voluntarily flood-proofed or elevated. Therefore, all residents within the reaches, irrespective of race, ethnicity, or income, would be able to choose to participate in the plan. These nonstructural measures may provide this area with hurricane and storm damage risk reduction

equivalent to structural measures, which are not economically justifiable due to the sparse populations scattered over a large area. Despite existing base floor elevations differing among individual structures, structure-raising would be capable of providing the same level of risk reduction benefits per structure at year 2075 (end of the period of analysis). Homeowners would be responsible for costs associated with any necessary repairs to ensure a structurally-sound home prior to elevation and would be responsible for temporary relocation costs during elevation. All other eligible costs of elevating structures, including the cost to elevate the structure, would not be borne by any single individual or the community; rather, these costs would be part of the proposed project costs.

Indirect impacts include a decrease in risk of damage from 1 percent, 2 percent and 4 percent annual exceedance storm events for minority and/or low-income populations in the study area. Population groups residing or working near elevation sites may experience indirect impacts due to the added traffic congestion and construction noise and dust. Trucks would transport equipment needed to elevate structures, which may increase traffic congestion in the area during construction activities. The environmental indicator (see table in Appendix A-2: Environmental Justice), "Traffic Proximity and Volume," shows the area to be at the 28th percentile in the state, which does not indicate an existing environmental risk or existing traffic congestion problems. Any additional traffic congestion caused by construction activities should not result in elevating the percentile to above the 80th percentile, which is representative of very poor traffic conditions. Truck traffic and noise along roads, highways and streets during project construction would cease following completion of construction activities. There may also be a degradation of the transportation infrastructure, primarily local roads and highways, as a result of the wear and tear from transporting construction materials. Best management practices would be used to avoid, reduce, and contain temporary impacts to human health and safety.

Six federally-recognized Tribes identified the three study area parishes as geographic areas of current and/or ancestral interest:

- Alabama-Coushatta Tribe of Texas
- Chitimacha Tribe of Louisiana
- Coushatta Tribe of Louisiana
- Jena Band of Choctaw Indians
- Mississippi Band of Choctaw Indians
- Tunica-Biloxi Tribe of Louisiana

Of these Tribes, only the Chitimacha Tribe of Louisiana currently holds lands within the study area and exercises sovereignty over that land. Chitimacha Tribal lands in the vicinity of Charenton, St. Mary Parish, would likely not be indirectly impacted by the proposed action since there are no structures in the 25-year floodplain and therefore indirect impacts associated with structure elevation would not occur.

Homeowners choosing to have their home elevated would be required to relocate to other housing until their home is elevated and ready for occupancy. The indirect impact

of having to find alternative housing would be temporary, but nonetheless a disruption to their current living arrangement.

Positive cumulative impacts from the nonstructural plan include reduced risk of hurricane storm surge-related damages to minority and/or low-income populations. If this alternative encourages regional economic growth, any additional jobs created may benefit minority and/or low-income groups living within the study area. For those living in structures in the 25-year floodplain that choose not to elevate, flood risk from future storm events (25-year and greater) would continue.

Alternative 2 – 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative but would involve a larger population and more structures.

Alternative 3 - No Action. The No Action Alternative would not provide coastal storm damage risk reduction or reduce storm surge flooding. Direct impacts to minority and/or low-income populations, including flood risk, would continue under this alternative. Indirect impacts under the No Action Alterative include a higher potential for temporary displacement of minority and/or low-income populations because residents within the study area would remain vulnerable to flooding and may be forced to relocate to areas with risk reduction features in place. Storm surge increase due to subsidence and sea level rise would exacerbate their vulnerability to flooding. Low-income populations may also find it more difficult to bear the cost of evacuation. This alternative would not contribute to any additional EJ issues when combined with other Federal, state, local, and private risk reduction efforts.

5.2.6 Cultural, Historic, and Tribal Trust Resources

Alternative 1 - 25 year Floodplain. A review of the NED plan indicates the considered action includes elevation and flood proofing measures that may introduce new visual elements and/or modifications to NRHP-listed or eligible built-environment resources. Those measures may directly affect both known and undocumented above-ground historic properties (e.g., standing structures and historic districts; see: Section 2.8.6.1), in a manner that may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. In addition, the NED plan includes ground disturbing activities (e.g., access, staging, foundation work, utility relocations and hardening) within the project footprint that may directly affect known and undocumented NRHP-listed or eligible archeological resources in a manner that may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

A review of the NED plan also indicates the considered action includes measures that may indirectly result in the introduction of new visual elements and/or modifications to the viewshed and overall visual landscape of known and previously undocumented cultural resources that may be listed or eligible for the NRHP. Those resources potentially include historic structures, NRHDs, NHLs, other built-environment resources (see: Section 2.8.6.1), and/or Traditional Cultural Properties (TCP). Effects would occur through the introduction of elements that are inconsistent with the historic or cultural character of these resources in a way that may indirectly diminish the visual integrity of

the property's setting, feeling, or association and/or cause changes to the integrity of feeling or character associated with a historic property or TCP.

Alternative 2 – 50-year Floodplain. The direct, indirect, and cumulative impacts to historic, cultural, and tribal resources for the considered action would be proportionally similar to the impacts specified for Alternative 1- 0.04 AEP (25-year) storm surge floodplain described above.

Cumulative Impacts. Cumulative impacts to historic, cultural, and tribal resources would be the additive combination of impacts by this and other federal, state, local, and private, hurricane storm surge damage risk reduction and other structural and nonstructural projects existing and/or authorized for construction along the coast including Southwest Coastal Louisiana, Morganza to the Gulf of Mexico, and others (see Table 1-1). Activities associated with these projects have the potential to directly and/or indirectly effect existing and previously undocumented resources within the project footprints, surrounding viewsheds, and communities they occur in.

In addition to those effects described previously under Alternative 1- 0.04 AEP (25-year) storm surge floodplain, potential negative cumulative impacts may include direct damage to built-environment resources or destruction of archaeological resources as well as the potential successive introduction of new visual elements and/or modifications to the viewshed and overall visual landscape of known and previously undocumented cultural resources significant at the state, local, and national level and/or of significance to tribes that may be listed or eligible for the NRHP; including archaeological sites, historic structures, NRHDs, NHLs, other built-environment resources (see above) and/or TCPs. Conversely, the proposed action may have long-term positive net impacts to cultural resources within communities in the study area. USACE acknowledges that nonstructural elevation and/or flood-proofing measures may result in modifications to historic buildings or other built-environment resources potentially not meeting the Secretary of the Interior's Standards (48 FR 44716-42, September 29, 1983). However, the overarching goal of this effort is to reduce risk from future flood events through elevation and flood-proofing, while still preserving the physical integrity and historic character of built-environment resources and in relation to other resources within a historic district (as applicable), thus; the proposed action may also have positive cumulative effects toward preserving at-risk unique architectural and design characteristics that many of Louisiana's historic communities strive to maintain and enhance. Otherwise, damage to, or loss of, cultural resources within the present study area in conjunction with other large-scale flood risk and coastal storm surge risk reduction projects in the region could lead to the loss of connection to place; causing a net loss of cultural diversity within study area and its surrounding communities. This is important because the cultural resources within many portions of the study area are understudied and/or not duplicated or replaced at other locations. Because most cultural resources are nonrenewable this would constitute a significant cumulative impact.

The USACE determined implementing the SCCL NED Plan may result in multiple Federal Undertakings, as defined by 54 U.S.C. § 300320 and 36 CFR § 800.16(y), may affect properties listed in or eligible for listing on the NRHP pursuant to 36 CFR Part 60

(historic properties) and/or properties having religious and cultural significance to Tribes including sites that may contain human remains and/or associated cultural items. However, identification and evaluation for these properties is ongoing in accordance with the procedures outlined in the "*Programmatic Agreement Among the U.S. Army Corps of Engineers, New Orleans District; Louisiana Coastal Protection and Restoration Authority; Louisiana State Historic Preservation Officer of The Department of Culture, Recreation & Tourism; Chitimacha Tribe of Louisiana; and Mississippi Band of Choctaw Indians, Regarding the South Central Coastal Louisiana Flood Risk Management Project*" (SCCL PA; Appendix A-3: Cultural Resources and Coordination), dated November 16 2020.

Alternative 3 - No Action. Impacts to historic, cultural, and tribal resources in southern Louisiana have resulted from both natural processes, (e.g., erosion) and human activities (e.g., land development, dredging, agriculture, and vandalism). Coastal environments are dynamic, and impacts to historic, cultural and tribal resources in the area would continue at current trend because of both natural processes including anthropogenic modifications of the landscape as well as human alterations.

5.2.7 Land Use

Alternative 1 - 25 year Floodplain. The SCCL study area consists of a mixture of private and public lands. The NED Plan measures would not significantly impact current land use patterns. Natural, agriculture, and urban land uses should continue to evolve over the life of the project in a stable setting with reduced storm surge impacts. The USACE did not identify any indirect impacts to land use planning efforts.

The nonstructural alternatives would not impair the implementation of any land use plans currently in place. See Section 6.5 for additional information.

Alternative 2 - 50 year Floodplain. Impacts would be the same as the 25-year floodplain alternative.

Alternative 3 - No Action. The study area should continue to be rural and predominately agricultural land use; however, urbanization and non-permeable surfaces should continue to expand at their current rate. This should continue with or without project. This may increase flash flooding and increased run-off. Local CSRM measures may result from the urban growth. Land under current parish, state, and Federal management should continue as public lands. These lands' missions are expected to remain as CSRM, fish and wildlife management, and recreation.

The study area communities would continually follow and update their planning documents in accordance with policy changes, land use trends, public opinion, and coordinated land use and emergency operating procedures.

5.2.8 Aesthetics and Visual Resources

Alternative 1 - 25 year Floodplain. The NED Plan would have minimal impacts on visual resources. Elevating homes would not impact view sheds into any surrounding areas. In areas where there is public access from a street or roadway, these

nonstructural elements would not change the view shed. Houses being raised are currently present, their elevation would change, but the site is still occupied either way. There may be some new visual limitations for residents living near elevated structures. These impacts should be minor since homes in a neighborhood may all be elevated commensurate with local flood conditions.

Alternative 2 – 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative, however, larger in scale because this alternative would cover a larger area and involve more structures.

Alternative 3 - No Action. Visual resources would continue to evolve from existing conditions because of both land use trends and natural processes over the course of time. The loss/conversion of swamps into marsh/open-water areas would continue, as would the accretion of land at the mouth of the Atchafalaya River and Wax Lake Outlet. The pleasing landscape would remain ephemeral, and visual resources would continue to be rich with biodiversity.

5.2.9 Water Quality and Salinity

Alternative 1 - 25-year Floodplain Indirect impacts would include the continuation of existing water quality trends as described in Section 2. The NED Plan would reduce the risk of damages resulting from flooding of structures within the study area, with drainage of floodwaters containing elevated nutrients, metals, and organics into water bodies connected to the Atchafalaya River and Bayou Teche basins. Into the future, the area would be affected by existing and proposed development (in particular, oil and gas development, agriculture, and climate patterns) (Mousavi et al., 2011).

Direct impacts of the nonstructural alternative would stem from construction for raising of structures.

Construction impacts to runoff would be minimized through implementation of a Stormwater Pollution Prevention Plan (SWPPP) (USEPA 2012). Any structure modification would adhere to applicable regulations pertaining to surface water quality, such as Louisiana Permitted Discharge Elimination System (LPDES) permitting. Structures not raised or demolished/removed face the risk of flooding and are capable of releasing constituents associated with structure and housed materials. Skrobialowski et, al (2007) documented for water quality impacts of flooded structures.

Alternative 2 – 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative, however, larger in scale because this alternative would cover a larger area and involve more structures.

Alternative 3 - No Action. Water quality trends would continue in a similar fashion as the current conditions. Without implementing an action alternative there would be an increased risk of damages resulting from flooding of structures within the study area, with drainage of floodwaters containing elevated salinity, nutrients, metals, and organics into water bodies connected to the Bayou Teche and Atchafalaya River Basins. In the future, existing and proposed restoration measures, natural geomorphologic processes,

development and agriculture, and climate patterns may exacerbate salinity level increases in the study area. (Mousavi, et al., 2011).

5.2.10 Aquatic Resources

Alternative 1 – 25-year Floodplain. The USACE would implement the NED Plan in developed/disturbed areas. This alternative would not impact any aquatic resources or wetlands in the study area. The NED Plan would not impact any Louisiana Natural Heritage Program designated rare, unique, and imperiled communities. The with-project conditions would be the continuation of existing conditions with coastal shoreline recession, and subsidence and land loss continuing at similar or increasing rates of change.

Because the proposed project is not located in wetlands, it would not disturb any wetlands and would not introduce or promote the spread of any aquatic invasive plant species.

Alternative 2 – 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative.

Alternative 3 - No Action. The No Action Alternative would result in the continuation of existing conditions with coastal shoreline recession, and subsidence and land loss continuing at similar or increasing rates of change. The loss of these coastal shorelines would adversely affect the extraordinary scenic, scientific, recreational, natural, historical, archeological, cultural, and economic importance of the coastal shorelines. The continued loss of coastal shorelines would result in the reduction and eventual loss of the natural protective storm buffering. Without the protective buffer provided by the coastal shorelines, interior estuarine wetlands would be at an increased risk to severe damage from hurricane storm events.

Without large-scale restoration efforts, the coastal land loss crisis would only worsen. Strategic prioritization and efficient implementation of projects may prevent Louisiana from losing an additional 2,250 square miles of land over the next 50 years.

The lack of sediment input in the areas outside of the Atchafalaya Basin, among other factors, would continue to lead to disintegration of the productive and protective wetlands, leaving coastal communities, industry and vital infrastructure increasingly vulnerable to storms.

The continued loss of coastal shorelines would result in the reduction and eventual loss of the natural protective storm buffering. Without the protective buffer provided by the coastal shorelines, interior estuarine wetlands would be at an increased risk to severe damage from hurricane storm events.

The CPRAB has plans to construct the Atchafalaya River Sediment Diversion. This project would provide basin-wide benefits to marshes in southwest Terrebonne Parish. Sediment and fresh water diverted into the marshes would help build land and sustain other nearby projects planned for construction, like Mauvais Bois Ridge Restoration. This project would have the greatest benefits to freshwater habitats, such as forested

areas, flotant and fresh and intermediate marsh, which are threatened by saltwater intrusion and sediment starvation (*Restore the Mississippi River Delta*, 2018).

The processes of wetland loss can result from the gradual decline of marsh vegetation due to inundation and saltwater intrusion, as well as from storm surge events, both can eventually lead to complete loss of marsh vegetation. As marsh vegetation is lost, underlying soils are more susceptible to erosion and are typically lost as well, leading to deeper water and precluding marsh regeneration. Significant accretion of sediments is then required in order for marsh habitat to reestablish.

Coastal Zone Federal Consistency

Alternative 1 – 25-year Floodplain. The USACE determined the proposed project would not have an effect on any coastal use or resource, which means any reasonably foreseeable effect on any coastal use or resource resulting from this action. This also includes effects on coastal uses. Effects include both direct effects resulting from the activity that occur at the same time and place as the activity, and indirect (cumulative and secondary) effects resulting from the activity that occur later in time or farther removed in distance but are still reasonably foreseeable (indirect effects).

In a letter dated October 1, 2019, the USACE submitted an initial Coastal Zone Consistency Determination (per 15 C.F.R. § 930.35) to the LDNR. In a letter dated October 23, 2019, the LDWF provided preliminary comments. The USACE intends to implement all the LDWF recommended wildlife monitoring and avoidance measures if this alternative is implemented. In a letter dated November 25, 2019, the LDNR stated, "After careful review, this office finds that this phase of the project, as proposed in the application, is consistent with the Louisiana Coastal Resources Program" (Appendix A-7: Coastal Zone Consistency Determination).

The USACE again submitted an updated Coastal Zone Consistency Determination on August 19, 2020 (Appendix A-7:Coastal Zone Consistency Determination) to document the changes since the project's earlier planning phase. This determination includes revised building numbers and wet floodproofing measures. In a letter dated October 19, 2020, the LDNR stated this project is "consistent with the LCRP [Louisiana Coastal Resources Program] in accordance with Section 307 (c) of the Coastal Zone Management Act of 1972, as amended. Should there be any future modifications to this project which have the potential to affect any land use, water use, or natural resource of the Louisiana coastal zone, please provide additional consistency determinations as appropriate to ensure compliance with the LCRP."

Alternative 2 – 50-year Floodplain. Impacts would be the same as or proportionally similar to the 25 year floodplain alternative, and as such, would not be expected to have an effect on any coastal use or resource.

Alternative 3 - No Action. The current coastal zone boundary in the study area should remain the same as the current condition throughout the study period.

Vegetation and Estuary Resources

Alternative 1 – 25-year Floodplain Since the nonstructural measures in this alternative would not take place in any aquatic habitat, vegetation and estuary resources would not be impacted.

Alternative 2 – 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative.

Alternative 3 - No Action. The current wetland gain/loss trends as well as a change in wetland composition would continue within vegetation zones in the study area. Both human-induced impacts and natural processes would contribute to the continued loss of vegetated habitats, including continued shoreline erosion and subsidence, increased saltwater intrusion, increased water velocities, and increased herbivory (Reed and Wilson, 2004). RSLR, land subsidence, development, and climate change may negatively impact all vegetation habitats over the study period. These factors may reduce the land coverage of native species and alter the species community. The USACE expects the land loss trend to continue over time resulting in the loss of these valuable vegetative communities. For example, without action, saltwater intrusion and drainage problems would continue, resulting in the conversion of freshwater marsh to intermediate and brackish marsh and eventual open water. These conditions would deteriorate the habitat diversity by reducing species (plant and animal) abundance and overall quantity of habitat. Invasive species abundance and diversity should increase throughout the study period.

Net marsh loss by 2050 is expected to be 97,505 acres (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority, 1999).

Wetland losses are predicted to result in:

- Some unknown extent of existing riverine BLH and associated swamp habitats would be converted to more efficient water conveyance channels as human populations and development increase.
- Some unknown extent of existing pasture and rangelands would be converted to rural, suburban and urban human habitats, generally in the order presented, as human populations and development increase.

Habitat switching would occur due to increasing sea level rise, subsidence, shoreline erosion and other land loss drivers.

Invasive species would continue to proliferate. New species would become problematic in the future. This would add additional pressures to native animals and natural ecosystems. Invasive species management would likely continue to use money that could be used for managing natural systems.

5.2.11 Fish and Wildlife Resources

Alternative 1 – 25-year Floodplain. Because the nonstructural measures in this alternative would not take place in any aquatic habitat, the NED Plan would have no direct, indirect, or cumulative impacts to aquatic and fisheries resources.

Alternative 2 - 50-year Floodplain. Impacts would be the same as the 25 year floodplain alternative.

Alternative 3 - No Action. Existing conditions and associated changes due to ecosystem drivers, would persist into the future. Increases in RSLR would increase saltwater intrusion and exacerbate ongoing conversion of estuarine wetlands to shallow open water and loss of existing estuarine fish habitats. Increases in RSLR could exacerbate ongoing conversion of existing aquatic organism distributions from an estuarine-dependent to more marine-dependent distribution. As habitat loss continues, there would be a corresponding reduction in overall species diversity and abundance as well as loss of estuarine nursery, foraging, refugia, and other estuarine aquatic habitats. Subject to the above-described limitations of the CWPPRA and LCA programs, aquatic and fisheries would benefit from restoration activities implemented by other programs such as CIAP, CWPPRA, beneficial use of dredged material; however, these activities are not enough to keep up with the current trends in habitat loss and RSLR.

5.1.12 Wildlife Resources

Alternative 1 – 25-year Floodplain. The NED plan would have no direct significant impacts on most wildlife resources except for human commensal wildlife (e.g., rats, mice, pigeons, etc.) that thrive in association with human habitations typically disrupting the natural habitats.

Depending on final designs of the NED plan, there could be a potential for minimal indirect impacts to colonial nesting water birds if there are residential or nonresidential structures near a colony of nesting birds. These impacts could include the temporary displacement of any birds that may be present due to construction activity and noise. The USACE assumes the birds would relocate to adjacent foraging/roosting grounds. Nesting birds would not be impacted as no work would take place within a rookery. In accordance with the LDWF, the USACE would follow survey, monitoring and avoidance measures outlined in their letter, dated October 23, 2019 (Appendix A-7:Coastal Zone Consistency Determination).

There would likely be no impacts to the bald eagle as no known nests are located near any project features. If an eagle's nest is found within the study area, the USACE would coordinate any potential disturbance activates with the USFWS.

Alternative 2 – 50-year Floodplain. Impacts and the USACE's avoidance measures would be the same as the 25-year floodplain alternative; however, larger in scale because this alternative would cover a larger area and involve more structures.

Alternative 3 - No Action. Existing conditions and changes caused by ecosystem drivers would persist. The RSLR, human encroachment and development, and other

factors would result in loss of existing wildlife estuarine, riverine, and bottomland hardwood forest habitats. Increases in RSLR would increase saltwater intrusion and exacerbate ongoing conversion of estuarine wetlands to shallow open water. As habitat loss continues, migratory Neotropical avian species would have less suitable stopover habitat forcing them to fly further to suitable habitat. Flying longer distances to find suitable stopover habitat could result in an increase in mortality resulting in a corresponding reduction in overall species diversity and abundance. Most mammalian, amphibian, and reptilian species would migrate to habitats that are more suitable. Wildlife would benefit from restoration activities implemented by other programs such as CIAP, CWPPRA, LCA and the beneficial use of dredged material; however, these activities are not enough to keep up with the current trends in habitat loss and RSLR.

5.2.13 Threatened/Endangered Species and Other Protected Species of Concern

Alternative 1 – 25-year Floodplain. Nonstructural measures would have No Effect on any listed species or critical habitat. In a letter dated, September 30, 2019, and an email dated November 14, 2020, the USACE coordinated this determination with the USFWS and NMFS (Appendix A-4: Endangered Species Act Coordination, & Appendix A-5: Magnuson-Stevens Fishery Conservation and Management Act Compliance).

The USACE would implement recommendations from USFWS and the NMFS and use the best available practical techniques and BMPs during implementation to avoid, minimize, and reduce potential adverse impacts to threatened and endangered species. This is in accordance with the Bald and Golden Eagle Protection Act (BGEPA), and MBTA.

Alternative 2 – 50-year Floodplain. The USACE's avoidance measures would be the same as the 25 year floodplain alternative.

Alternative 3 - No Action. With or without the proposed project, land loss would directly reduce the availability of habitat for threatened and endangered species. Piping plover would lose access to some forage and roosting habitat as it shifts to shallow open water. As interior marshes are lost, shoreline retreat rates increase. For coastal habitat, utilized by sea turtles, shoreline retreat rate would continue. The continued erosion of the gulf coast shoreline would result in additional salt water intrusion into the interior wetlands area resulting in additional marsh loss. Conversely, the recently delisted brown pelicans would gain access to more shallow water foraging areas, resulting from the shoreline retreat. Indirect effects would be the continued reduction of piping plover critical wintering habitat due to coastal erosion.

Without action, there would be the continued degradation and loss of emergent wetland habitats used by many different fish and wildlife species for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements. The loss and deterioration of transitional wetland habitats over time could continue to indirectly affect, to an undetermined degree, all listed species that may potentially utilize the area including: Gulf sturgeon, piping plovers, red knots, green sea turtles, Kemp's Ridley sea turtles, loggerhead sea turtles, hawksbill sea turtles, leatherback sea turtles, and the West Indian manatee. If habitat loss goes unabated, the recovery of some sensitive/delisted

species such as brown pelican, bald eagle, and colonial nesting birds could be indirectly impacted.

5.2.14 Air Quality

Alternative 1 – 25-year Floodplain. No aspect of the proposed project, neither short-term nor long-term, has been identified that would potentially result in violations to air quality standards. The environment would not be exposed to contaminants/pollutants in such quantities and duration injurious to human, plant, or animal life, or property, or which unreasonably interferes with the comfortable enjoyment of life, or property, or the conduct of business. Fugitive dust levels may increase at construction sites but should be short term in nature.

Alternative 2 – 50-year Floodplain. The USACE's avoidance measures would be the same as the 25-year floodplain alternative.

Alternative 3 - No Action. The study area would continue to be subject to air pollutants from mobile sources including vehicles traveling on city roads in the study area. The study area's permitted air pollution sources should remain in compliance and not significantly impact sensitive resources.

5.2.15 Noise

Alternative 1 – 25-year Floodplain. Overall, heavy machinery would generate an increase in noise levels throughout the project areas during construction hours and temporarily disturb residents and businesses. Noise levels would return to their current state after construction. The project would not likely increase noise levels in the study area.

Alternative 2 – 50-year Floodplain. The USACE's avoidance measures would be the same as the 25 year floodplain alternative.

Alternative 3 - No Action. Future ambient noise levels within the study area would continue to be influenced by land uses including industrial, commercial, residential and agricultural areas. Noise sources include primarily vehicular traffic, trains, and large transport vehicles travelling in the project area. Secondary noise sources include industrial activities, construction sites and transportation routes (parish roads). Noise levels would not increase during the period of analysis.

5.2.16 Hazardous, Toxic, and Radioactive Waste

Structural damages associated with flooding events and debris deposition would are expected to continue in the FWOP condition. The hydrology and hydraulics existing and FWOP forecast a reoccurance internal of 0.04 AEP (25-year event) in the project area. Associated sedimentation and desbis deposition in structure is forecasted to occur in the FWOP. Sediment being transported from within the watershed has the potential be be contaminanted. This potential risk for deposition of contamindated sediment would remain the same between future without and future with as no measures proposed in the NED plan would influence the sediment input throughout the watershed,

For each residential structure, the NFS would fund an American Society Testing Materials (ASTM) Phase I HTRW/asbestos investigation (and if warranted, may be accompanied by additional HTRW investigations), inspections, surveys, and boundary monumentations. The land and the structure must be certified as "clean" by the appropriate State office before any project funds may be expended. All asbestos must be abated and disposed of properly. Asbestos discovered during floodproofing would be removed at Project cost, while HTRW discovered floodproofing must be remediated by the property owner prior to the initiation of the floodproofing work. See Appendix K for additional details.

Alternative 1 – 25-year Floodplain. The NFS would conduct Phase 1 HTRW assessments for each structure subject to modification and acceptance into the project. Compliance with applicable hazardous waste management laws and regulations (e.g., RCRA, CERCLA) would be achieved prior to construction. If any substances regulated under these laws were discovered, the NFS would comply with all applicable requirements. Since compliance with hazardous waste management laws and regulations is an eligibility criterion prior to construction, no impacts arising from any HTRW issues are anticipated with implementation of the project. Wet floodproofing activities evaluated as part of the future with project conditions, would not increase the potential for HTRW impacts over the FWOP Conditions. Wet floodproofing design criteria allows for water (surge) exchange and flow rates the same as the existing conditions (No Action).

Implementation of Alternative 1 measures may indirectly result in a minor benefit in the future with project if properties are remediated as a condition of eligibility.

Alternative 2 – 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative; however, larger in scale because this alternative would cover a larger area and involve more structures.

Alternative 3 - No Action. Currently landowners are responsible for hazardous material handling and waste management in accordance with the RCRA. Compliance with RCRA is unknown at this time for the entire project area. Properties not in compliance risk the potential for release of HTRW materials into the storm water and into adjacent wetlands and water bodies as the surge recedes.

5.2.17 Soils

This discussion includes potential impacts to:

- Sedimentation and Erosion
- Prime and Unique Farmlands
- Post storm clean up of sediment and debris.

Alternative 1- 25-year Floodplain. Since this alternative is a nonstructural alternative, it would have no direct or indirect impacts on soils, prime and unique farmlands, or water bottoms. Implementation of wet floodproofing measures in the warehouses are not expected to significantly increase or decrease the quantity, quality, or duration of

floodwaters moving into and out of the structures during flooding. These features merely reduce damage to the structure during the flood event. As the quality, quantity and duration of flooding in the structures are not expected to change for the with-project condition, the quantity and quality of sediment deposited in the warehouses during a storm event is not expected to differ from the existing condition.

There should be no additional exposure to contaminanted sediment of debris to commercial property owners, warehouse operators, and homeowners compared to the No Action Alternative. Because of current LDEQ emergency storm clean up protocols, environmental exposure to contaminated sediment and debris is monitored and regulated. With improved technology, future best management practices and required procedures for storm clean up would improve over the project life potentially reducing future environmental impacts to humans and the natural environment.

Alternative 2- 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative; however, larger in scale because this alternative would cover a larger area and involve more structures.

Alternative 3- No Action. The No Action alternative would result in persistence of current sedimentation and erosion patterns. Existing hydrologic alterations would continue to affect water levels and salinities and continue influencing land loss at similar or increased rates. The RSLR would expose additional shoreline areas to erosive forces into the near future. Couvillion et al. (2011) predict coastal Louisiana is potentially at risk of losing between 2,118 and 4,677 km^2 of land over the next 50 years. This would be a potential loss of between 14.6 percent and 32.3 percent of the remaining coastal wetlands in the state over the next 50 years (exclude Atchafalaya Basin). The uncertainty range for wetland change projections represents anywhere from a 32.2 percent reduction to a 49.6 percent increase in the average wetland loss rates experienced from 1932–2010 (Couvillion et al., 2011). These results suggest that a net wetland loss in coastal Louisiana over the next 50 years would likely occur regardless of uncertainties in parameters that influence coastal wetland loss.

The No Action Alternative would result in the continuation of existing conditions with coastal shoreline recession, subsidence and land loss continuing at similar or increasing rates of change with concomitant increase in shallow open waterbottoms. As RSLR increases and areas become inundated by salt water, prime farmlands could be lost. As human populations and development increase, prime farmlands could be converted to suburban, urban, and industrial uses and areas available for agricultural use would decrease. gulf shoreline recession rates, varying between +8 feet to -52.9 feet per year, would result in gulf shoreline rollover onto interior marshes, and change in land use patterns from forested areas to agriculture and grazing pasture. Soils identified as prime farmlands would also be susceptible to flooding events and subsidence and could be lost as RSLR increases.

Future storm events would carry or resuspend pollutants, such as nutrients, heavy metals, organic chemicals, bacteria and other pathogens. Some would be dissolved into the water and washed away quickly, while others may remain stuck to sediment for

years. Emergency storm clean up protocols are in place to reduce human exposure to contaminatedsediment and debris. Future stoms would potentially expose humans and the natural environmetment to contaminatedsediment and debris, but advances in storm clean up may reduce this exposure.

5.2.18 Sustainability, Greenhouse Gas Emissions, and Climate Change

Alternative 1 – 25-year Floodplain. Although the magnitude of the effects of climate change, including rising sea levels, temperature changes, and changing rainfall patterns, is uncertain, it is generally acknowledged that climate change would affect both natural systems and human environmental conditions in south Louisiana during the next century. Scientists and agency water managers agree that implementation of this alternative would provide an important adaptation response for both the natural system and the human environment. The USACE would analyze the effects of sea level change on the benefits predicted for the Alternative 1 per ER 1100-2-8162, "Incorporating Sea Level Change in Civil Works Programs" (31 December 2013). For more information, refer to Appendix C Hydraulics, Hydrology, and Climate Preparedness and Resiliency.

Alternative 1 would boost the resiliency to potential climate change effects by increasing FRM abilities and buffering the effects of sea level rise and land subsidence.

Since the NED Plan includes voluntary participation, it is difficult to predict the social cost of each house elevation, wet floodproofing activity, or dry proofing activity that would take place, and the subsequent greenhouse emissions per event. Plans and specs would require any contractor to adhere to standard equipment maintenance and insuring their equipment is efficiently operated to reduce greenhouse gas emissions.

The potential project features would not contribute to long-term climate change patterns or have direct or indirect impacts contributing to climate change. Project construction would generate greenhouse gas emissions, but the de minimus level would not significantly contribute to social costs of carbon, nitrous oxide, and methane, induced climate change impacts. Appendix C outlines the PDT's prediction analysis tools and resources.

This analysis is in compliance with the SAIE-ESO memo dated 4 March 2021, subject: Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in Army National Environmental Policy Act Reviews.

Alternative 2 – 50-year Floodplain. Impacts would be the same as the 25-year floodplain alternative; however, larger in scale because this alternative would cover a larger area and involve more structures.

Alternative 3 - No Action. In the next few decades, the USACE expects longer growing seasons and rising CO_2 levels would increase yields of some crops, though such benefits would be progressively offset by extreme weather events. Though adaptation options can reduce some of the detrimental effects, in the long-term, the combined stresses associated with climate change may decrease agricultural productivity.

The climate change assessment tools, used in the study are consistent with USACE Engineering and Construction Bulletin (ECB) 2016-25, Guidance for Incorporating Climate Chance Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects to provide an indication of the potential for non-stationery and impact to flood risk. Appendix C, Hydraulics, Hydrology, and Climate Preparedness and Resiliency, has additional discussion on climate change.

The USACE projects, programs, missions, and operations have generally proven to be robust enough to accommodate the range of natural climate variability over their operating life spans. However, recent scientific evidence shows in some places and for some impacts relevant to USACE operations, that climate change is shifting the climatological baseline natural climate variability and may be changing the range of variability as well. This is relevant to the USACE because the assumptions of stationary climatic baselines and fixed range of natural variability, as captured in the historic hydrologic record may no longer be appropriate for long-term projections of flood risk.

The USACE considered climate change impacts on the hydrology of the study area in accordance with ECB 2016-25, Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs and Projects, as well as USACE Engineering Technical Letter 1100-2-3, Guidance for Detection of Nonstationarities in Annual Maximum Discharges.

Section 6
Environmental Compliance

6.1 ENVIRONMENTAL OPERATING PRINCIPLES

The USACE developed Environmental Operating Principles (EOPs) to ensure USACE missions include totally integrated sustainable environmental practices. The EOPs provided corporate direction to ensure the workforce recognized the USACE role in, and responsibility for, sustainable use, stewardship, and restoration of natural resources across the Nation and, through the international reach of its support missions.

Since the Environmental Operating Principles were introduced in 2002, they have instilled environmental stewardship across business practices from recycling and reduced energy use at USACE and customer facilities to a fuller consideration of the environmental impacts of USACE actions and meaningful collaboration within the larger environmental community.

The re-energized Environmental Operating Principles are:

- Foster sustainability as a way of life throughout the organization.
- Proactively consider environmental consequences of all USACE activities and act accordingly.
- Create mutually supporting economic and environmentally sustainable solutions.
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the USACE, which may impact human and natural environments.
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
- Leverage scientific, economic and social knowledge to understand the environmental context and effects of USACE actions in a collaborative manner.
- Employ an open, transparent process that respects views of individuals and groups interested in USACE activities.

The USACE incorporated environmental sustainability into this study planning. This should result in an efficient, "green" project while reducing flood risk. The plan is consistent with all applicable laws and policies. The USACE and its NFS continue to meet their corporate responsibility and accountability for the project in accordance with those laws and policies. The study team is using appropriate ways and means to assess cumulative impacts to the environment through the NEPA and the use of engineering models, environmental surveys and coordination with natural resource agencies. As a result of employing a risk management and systems approach throughout the life cycle of the project, the project design would address as many concerns as possible with no mitigation required to address adverse impacts.

6.2 ENVIRONMENTAL COMPLIANCE

The NEPA requires a summary of public participation, detailed in this section. In addition to NEPA, the USACE is in ongoing coordination with the resource agencies as required by other federal laws, statutes, and EOs, and is detailed in this section as well.

6.2.1 Scoping

The USACE held five study kickoff meetings at the start of the SCCL planning process. These included one resource agency meeting, two community and levee USACE leaders' meetings and two public meetings (Appendix J: Public Involvement and Scoping).

The USACE issued a NOI to prepare an EIS for the SCCL project in the Federal Register (Vol. 84, No. 63 on April 2, 2019. The NOI included a 45-day public comment period, ending on May 17, 2019. On April 10, 2019, the USACE sent cooperating agency letters to the USFWS and NOAA (NMFS). The USACE sent a cooperating letter to the Federal Emergency Management Agency on May 22, 2019 (Appendix J: Public Involvement and Scoping). The USACE held two public scoping meetings on May 14 and 15, 2019. Appendix J: Public Involvement and Scoping, details these meetings.

6.2.2 Agency Coordination and Public Involvement

In accordance with 33 C.F.R § 385.26(a), required consultation, as defined in 33 CFR § 385.3, continues with all required agencies, including:

- Department of the Interior
- USEPA
- Department of Commerce
- Federal Emergency Management Agency
- Chitimacha Tribe of Louisiana
- Louisiana Coastal Protection and Restoration Authority
- Other federal, state, and local agencies as designated in 33 CFR § 385.26(a).

In accordance with 33 C.F.R § 385.26(e)(3), required coordination, as defined in 33 CFR § 385.3, occurred with all required agencies, including:

- USFWS
- NMFS
- US Geological Service (USGS)
- LDNR
- Louisiana Department of Wildlife and Fisheries
- Other appropriate agencies as required by applicable law.

The project delivery team consists of those individuals designated by the USACE and CPRAB, the implementing agencies, and representatives designated by other government agencies or tribes. Inter-agency participation is encouraged to gain the technical skills and knowledge of other agencies. Several federal, tribal, and state

agencies are active USACE partners. Participants include the USEPA, USFWS, USGS, and LDGF. Representatives from St. Martin, St. Mary, and Iberia parishes, as well as levee districts, and community representatives are also active participants.

Agencies including the NOAA, USFWS, FEMA, and the tribes were asked at the beginning of the planning process to become cooperating agencies under NEPA. In a letter dated May 17, 2019, NOAA agreed. Due to the robust interagency process planned for this project, the other agencies and tribes did not wish to enter into a cooperating agency agreement; however, these agencies were fully involved in all phases of the SCCL planning process.

The USACE used periodic resource agency webinars at key phases of the SCCL planning process during the formulation of project objectives, management measures, and evaluation of alternatives.

In a letter dated October 2, 2019, NOAA indicated they were stepping down as a cooperating agency (Appendix J: Public Involvement and Scoping). Their reasoning was based on the NED Plan's lack of potential impacts on NOAA trust resources, such as marine mammals, endangered species and EFH.

Public outreach efforts for the SCCL study began early in the planning process and was done in compliance with 33 CFR § 385.18. Due to intense public, political, and media interest in FRM in southern Louisiana, public participation is a critical component of the development of this feasibility report. Appendix J Public Involvement and Scoping details the USACE's public involvement activities.

The USACE held monthly stakeholder briefs to provide study updates and encourage participation with project activities needed for selection of the NED Plan. The attendees include congressional delegation, NFS, and stakeholders. Communication is key to project success and keeping the study partners apprised of the latest progress. The USACE initiated the meetings in June of 2019. Some of the topics included takeaways from public meetings, schedule, review, and screening of the alternatives.

The USFWS provided their Final Coordination Act Report on November 30, 2020 (Appendix A-6: Fish and Wildlife Coordination Act). These comments were provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended. They provided the following recommendations to avoid and minimize possible impacts associated with implementation of nonstructural measures:

1. Should construction of earthen berms around a structure result in impacts to adjacent wetlands, a sheetpile barrier shall be constructed in lieu of earthen berms to avoid or minimize those wetland impacts.

USACE Response: The USACE is not considering earthen berms as part of nonstructural measures in their NED Plan. Further, the USACE does not anticipate impacting any wetlands for any of the nonstructural measures.

2. If a bald eagle nest occurs or is discovered within 660 feet of the proposed project area, then an evaluation must be performed to determine whether the project is likely to

disturb nesting bald eagles. That evaluation may be conducted on-line at: http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, that website would provide a determination of whether additional consultation is necessary.

USACE Response: The USACE would comply with the Bald and Golden Eagle Protection Act if any proposed construction is within 660 feet of a bald eagle nest.

3. On-site contract personnel be informed of the need to identify colonial nesting birds and their nests and should avoid affecting them during the breeding season. Should on-site contractors and inspectors observe potential nesting activity, coordination with the LDWF and the Service should occur.

USACE Response: The USACE would have a qualified biologist on hand to verify any proposed construction would not affect any colonial nesting birds during the breeding season. If there are active nesting colonies near any construction sites, the USACE would coordinate these project sites are coordinated with the USFWS and LDWF

4. The USACE should coordinate closely with the Service and other fish and wildlife conservation agencies throughout the planning, engineering and design of project features to ensure that those features are located and designed to avoid and minimize wetland impacts and associated fish and wildlife resources.

USACE Response: The USACE would continue to coordinate this project through the planning, design, and construction phases. If the project changes, the USACE would coordinate these changes with the state and federal resource agencies prior to finalizing any phase. The USACE would integrate any recommendations, requirement, and/or statutory mitigation if required based upon the agencies' comments and authority.

5. The USACE should obtain a right-of-way from the Service prior to conducting any work on Bayou Teche NWR, in conformance with Section 29.21-1, Title 50, Right-of-Way Regulations. Issuance of a right-of-way would be contingent on a determination by the Service's Regional Director that the proposed work would be compatible with the purposes for which the Refuge was established.

USACE Response: If the USACE's NED Plan does change and would require any right-of-way needs on USFWS fee title-managed lands including the Bayou Teche NWR, the USACE would obtain all the necessary real estate agreement documentation in accordance with Section 29.21-1, Title 50, Right-of-Way Regulations. The USACE would work closely with refuge and other USFWS staff to ensure any project needs would be compatible with the refuge's land management and protection of its natural and recreational resources.

6. All planning, design, or other construction-related activities (e.g., surveys, geotechnical borings, etc.) conducted on NWRs would require the USACE to obtain a Special Use Permit from the Refuge Manager of the Southwest Louisiana Refuge Complex. We recommend that the USACE request issuance of a Special Use Permit well in advance of conducting any work on the refuge. Please contact the Refuge Manager [redacted] or SWLRComplex@fws.gov) for further information on

compatibility of proposed ecosystem restoration measures, and for assistance in obtaining a Special Use Permit. Close coordination by both the USACE and its contractor must be maintained with the Refuge Manager to ensure that construction and maintenance activities are carried out in accordance with provisions of any Special Use Permit issued by the NWR.

USACE Response: If there is any proposed construction on USFWS refuge lands, the USACE would obtain a special use permit from the Refuge Manager.

7. The Service recommends that the USACE contact the Service for additional consultation if: 1) the scope or location of the proposed project is changed significantly, 2) new information reveals that the action may affect listed species or designated critical habitat; 3) the action is modified in a manner that causes effects to listed species or designated critical habitat; or 4) a new species is listed or critical habitat designated. Additional consultation as a result of any of the above conditions or for changes not covered in this consultation should occur before changes are made and or finalized.

USACE Response: If the NED Plan changes in any way such that USFWS-managed lands may be affected, or threatened, endangered species, or their critical habitats may be affected, the USACE would first contact the USFWS and coordinate and consult the activities prior to construction.

In a letter dated October 31, 2019, the LDNR, OCM, provided several LDWF recommendations in accordance with the Coastal Zone Management Act of 1972 (Appendix A-7). These recommendations focused on state listed species, bald eagle nests, colonial nesting bird colonies, and critically imperiled forest stand protection.

USACE Response: The USACE concurs with the LDNR and LDWFs' concerns and warnings concerning T&E species and colonial nesting birds, and sensitive habitats. The District acknowledges the LDWF warnings and bird nesting colony instructions and endorse these statements. If after the USACE's planning efforts and the project is carried forward for developing plans and specifications, the USACE would add any limitations in the appropriate contract documents set out by the LDWF's October 21, 2019, letter. Further, during construction, the USACE would carry out any survey, monitoring and reporting requirements associated with impact avoidance to any LDWF trust resources.

6.2.3 Draft Feasibility Study and Environmental Impact Statement

The South Central Coast Louisiana Draft Feasibility Study with Integrated Environmental Impact Statement dated September 2019 was available for public review from November 22, 2019-January 6, 2020 (Federal Register Notice of Availability 22 Nov 2019, EIS No. 20190280). The Recommended Plan was Alternative 1 consisting of implementation of nonstructural floodproofing measures on a total of 3,463 structures including residential buildings, commercial buildings, public buildings, and warehouses. A total of 42 comments were received during the review (Appendix J). The comments were generally in favor of structural measures and were concerned with costly federal

levee standards. Other comments focused on ways to improve the shrimping industry and baseline environmental information.

6.2.4 Final Feasibility Study and Environmental Impact Statement

The South Central Coast Louisiana Final Feasibility Study with Integrated Environmental Impact Statement dated June 2021 was available for public review from September 3 - October 4, 2021, (Federal Register Notice of Availability 03 September 2021, EIS No. 20210131). The Recommended Plan was a refinement of Alternative 1 and consisted of implementation of nonstructural floodproofing measures on a total of 2,240 structures including residential buildings, commercial buildings, public buildings, and warehouses. Alternative 1 had a reduction in number of residential, commercial, and public buildings deemed preliminary eligible to receive nonstructural floodproofing – residential buildings (~30 percent reduction), commercial buildings (~60 percent reduction) and public buildings (~55 percent reduction). The number of potential warehouses to be floodproofed increased by 10 percent and the method of floodproofing changed from dry floodproofing (seal structure to a specific heigh, elevate electrical and HVAC) to wet floodproofing. Warehouse wet floodproofing measures in the refined Alternative 1 included installing vents in buildings, elevating electrical and HVAC, constructing elevated modular offices and installing hoists and shelves to elevate and protect building contents in advance of storms. During the Final EIS's 30-day review period, the USEPA provided a comment stating it had no objection to this proposed action (Appendix J).

6.2.5 Draft Supplemental Feasibility Study and Environmental Impact Statement

The South Central Coast Louisiana Draft Supplemental Feasibility Study with Integrated Environmental Impact Statement dated April 2022 was available for public review from April 1 - May 16, 2022, (Federal Register Notice of Availability 01 April 2022, EIS No. 20220042). The supplemental draft served to adequately inform the public of the changes made to the Recommended Plan since the last 45-day public comment period in November 2019. The Recommended Plan was a further refinement of Alternative 1 evaluated in the Final IFR/EIS, above. There was no change in the number and type of structures deemed preliminary eligible to receive nonstructural floodproofing. The following measures were no longer recommended for implementation at the warehouses: constructing elevated modular offices and installing hoists and shelves. The RP includes the following warehouse wet floodproofing measures: installing vents in buildings and elevating electrical and HVAC. The USEPA provide the only comment during the 45-day comment period. In a letter dated May 10, 2022, the USEPA stated it has no comments on the proposed action (Appendix J).

6.2.6 Final Feasibility Study and Environmental Impact Statement

The South Central Coast Louisiana Final Feasibility Study with Integrated Environmental Impact Statement dated June 2021 was available for public review from September 3 -October 4, 2021, (Federal Register Notice of Availability 03 September 2021, EIS No. 20210131). The Recommended Plan was a refinement of Alternative 1 and consisted of implementation of nonstructural floodproofing measures on a total of

2,240 structures including residential buildings, commercial buildings, public buildings, and warehouses. Alternative 1 had a reduction in number of residential, commercial, and public buildings deemed preliminarily eligible to receive nonstructural floodproofing – residential buildings (~30% reduction), commercial buildings (~60% reduction) and public buildings (~55% reduction). The number of potential warehouses to be floodproofed increased by 10% and the method of floodproofing changed from dry floodproofing (seal structure to a specific heigh, elevate electrical and HVAC) to wet floodproofing. Warehouse wet floodproofing measures in the refined Alternative 1 included installing vents in buildings, elevating electrical and HVAC, constructing elevated modular offices and installing hoists and shelves to elevate and protect building contents in advance of storms. During the Final EIS's 30-day review period, the USEPA provided a comment stating it had no objection to this proposed action (Appendix J).

6.2.7 Comments and Responses

Appendix J: Public Involvement and Scoping contains a comment response matrix detailing the comments received during the NEPA review process for the November 2019 Draft FR/EIS, along with USACE responses. The USACE integrated all the comments into the Draft Supplemental FR/EIS. Appendix J also has the comment letters received from each subsequent review period described above.

6.2.8 Statement Recipients

A copy of the Final Supplemental FR/EIS is posted on the USACE website at the following address:

https://www.mvn.usace.army.mil/South-Central-Coast/

Notice of its availability was emailed to Federal, state, and local agencies; affected Native American tribes; congressional offices, media outlets, municipalities, levee districts, and interested private organizations and individuals (Appendix J: Public Involvement and Scoping).

6.2.9 Compliance with Environmental Laws, Statutes and Executive Orders

Table 6-1 identifies the status of coordination with other Federal agencies and compliance with major environmental statutes.

Table 6-1. Environmental Compliance Status

Law, Policy and Regulations	Status	Comments
Anadromous Fish Conservation Act	Fully Compliant	Proposed action would not adversely affect anadromous fish species.
Archaeological Resources Protection Act of 1979	Fully Compliant. The SCCL complies with this Act and would continue to comply throughout construction and operation and would obtain any required permits.	A Federal Permit under the Archaeological Resources Protection Act (ARPA), Approved October 31, 1979 (Public Law 96-95; 93 Stat. 721; 16 U.S.C 470aa-II; 32 CFR 229) would be obtained from the appropriate Federal land manager for all archaeological work occurring within federal and Indian lands in the United States, and the removal and disposition of archaeological collections from those sites.
American Indian Religious Freedom Act	Fully Compliant	The policy of the U.S. is to protect and preserve for American Indians, Alaska Native Groups, and Native Hawaiians inherent rights of freedom to believe, express, and exercise traditional religions. These rights include, but are not limited to, access to sites, use and possession of sacred objects, and the freedom to worship through ceremony and traditional rites.
Bald and Golden Eagle Protection Act	Fully Compliant	Proposed action would not adversely affect the bald eagle. No permits for takes are required. If a bald eagle nest occurs or is discovered within 660 feet of the proposed project area, the USACE would complete an evaluation to determine whether the project is likely to disturb nesting bald eagles. The evaluation would be coordinated with the USFWS prior to the proposed work. This evaluation and coordination is in compliance with the USFWS's recommendations (Appendix A-6).
Clean Air Act	Fully Compliant. SCCL would comply with this Act as applicable based on detailed design; would obtain any required permits.	Potential for permanent sources of air emissions. Air emissions permits may be required for temporary construction events.
Clean Water Act of 1972	Fully Compliant. The SCCL complies with this Act. The recommended plan would not impact any waters in the U.S. and a 401 WQC from the State	The USACE does not anticipate any impacts to the Waters of the United States. Any short-term construction activities may require NPDES permits.

Law, Policy and Regulations	Status	Comments
	of Louisiana is not required.	The project does not have any wetland fill activities.
Coastal Barrier Resources Act and Coastal Barrier Improvement Act of 1990	These Acts are not applicable to this project.	The project would not affect any designated coastal barrier resources.
Coastal Zone Management Act of 1972	Fully Compliant. The SCCL complies with this Act and obtained concurrence by the State of Louisiana	In a letter dated October 1, 2019, the USACE prepared a Louisiana Coastal Zone Consistency Determination (Negative Determination) in accordance with the provisions of 15 CFR Part 930 (Appendix A-7). The USACE determined the proposed action is consistent to the maximum extent practicable with the enforceable policies of Louisiana's approved Coastal Zone Management Program. In a letter dated October 14, 2020, the LDNR stated, "After careful review, this office finds that this phase of the project, as proposed in the application, is consistent with the Louisiana Coastal Resources Program" (Appendix A-7).
Endangered Species Act of 1973	Fully Compliant. The USACE is complying with this Act and consulting with NMFS and USFWS as appropriate.	In a letter dated September 30, 2019, and an email dated November 14, 2020, the USACE provided its No Effect determination and reasoning to the USFWS (Appendix A-4). The USFWS replied to the USACE's determination on November 30, 2020. In a letter dated September 30, 2019, the USACE provided its No Effect determination and reasoning to the NMFS (Appendix A-5 Magnuson-Stevens Fishery Conservation and Management Act Compliance).
Estuary Protection Act of 1968	Fully Compliant	The project would not affect any estuary resources.
Farmland Protection Policy Act of 1981	Fully Compliant	The project would not affect any prime or unique soils.
Federal Water Project Recreation Act/L&WCF Act	Fully Compliant	The USACE evaluated the proposed action's effects on outdoor recreation. The proposed action would not adversely affect existing recreational opportunities.
Fish and Wildlife Coordination Act of 1958, as	Fully Compliant	The USACE coordinated the proposed action with the USFWS and NMFS. The USFWS and NMFS

Law, Policy and Regulations	Status	Comments
amended.		are active participants on the SCCL team and provided information on fish and wildlife elements for the project. The USFWS provided a Planning Aid Letter on November 18, 2018. The USFWS provided their Final Coordination Act Report on November 30, 2020 (Appendix A-6: Fish and Wildlife Coordination Act).
Magnuson-Stevens Fishery Conservation and Management Act	Fully Compliant	No elements of the proposed project would be in any EFH. Therefore, the project would not affect any EFH. See Appendix A-5 Magnuson-Stevens Fishery Conservation and Management Act Compliance for the USACE's No Effect coordination/documentation.
Marine Mammal Protection Act of 1972	Fully Compliant	No elements of the proposed project would be in any marine mammal habitat.
Marine Protection, Research and Sanctuaries Act	This Act is not applicable.	Ocean disposal is not a component of this project; therefore, this Act is not applicable.
Migratory Bird Treaty Act of 1918	Fully Compliant. The USACE is in compliance now and would continue to be compliant with the Act at the time of construction.	The proposed action would not significantly adversely affect migratory bird species. The USACE is in compliance and would continue to be compliant with the Act at the time of construction.
National Environmental Policy Act of 1969	Fully Compliant	On April 2, 2019, a NOI to prepare an EIS was published in the Federal Register (81 Fed. Reg. 137). The USACE held public scoping meetings on May 14 and 15, 2019 in St. Martinsville and Morgan City, LA. A NOA of the Draft EIS was published in the Federal Register (83 Fed. Reg. 130; 83 FR 31535) on November 22, 2019, and mailed to interested stakeholders to begin the 45-day review period. The review period closed on January 6, 2020. All comments received during the public meetings and the review periods, along with responses, are included in Appendix J. Following public and agency review and comment on the Draft EIS, public and agency review of the subsequent Final EIS, and the signing of the ROD, this project would be in full compliance with this Act.

Law, Policy and Regulations	Status	Comments
NHPA of 1966	Fully Compliant	USACE has determined that implementing the recommended plan may result in multiple Federal Undertakings, as defined by 54 U.S.C. § 300320 and 36 CFR § 800.16(y), that may affect properties listed in or eligible for listing in the NRHP pursuant to 36 CFR Part 60 (historic properties) and/or properties having religious and cultural significance to Tribes including sites that may contain human remains and/or associated cultural items. Because the scope and programmatic nature of the SCCL Project makes it unreasonable to fully identify historic properties or determine the effects of these Undertakings at the present time, USACE concluded that a phased process to conduct identification and evaluation of historic properties (36 CFR § 800.4(b)(2)) and for application of the criteria of Adverse Effect (800.5(a)(3)), is an appropriate and necessary approach for the agency to meet the requirements of Section 106. Accordingly, USACE executed the SCCL PA, dated November 16, 2020, in consultation with stakeholders (Appendix A-3), as provided for in 36 CFR § 800.14(b)(1)(ii), to fulfill its obligations under Section 106 of the NHPA, including the resolution of Adverse Effects for these Undertakings, and allow USACE to coordinate Section 106 reviews with its evaluation of the proposed action's potential for significant impacts to the human and natural environment required by NEPA, as amended (42 U.S.C. § 4321 et seq.).
Native American Graves Protection and Repatriation Act	Fully Compliant	This Act applies to federally owned lands, including reservation lands.
Resource Conservation and Recovery Act, as Amended by the Hazardous and Solid Waste Amendments of 1984; CERCLA, as Amended by the Superfund Amendments and Reauthorization Act of 1986; Toxic Substances Control Act of 1976.	Fully Compliant	The NFS~~landowner~~would conduct Phase 1 HTRW assessments on a case-by-case basis depending on each property subject to modification and acceptance into the project. Compliance with this Act would be achieved prior to land certification. If any items regulated under these laws were discovered, the landowner and the Nonfederal Sponsor would comply with applicable requirements. See Appendix K for additional

Law, Policy and Regulations	Status	Comments
		details.
Rivers and Harbors Act of 1899	Fully Compliant	The proposed action would not obstruct navigable waters of the United States.
Submerged Lands Act of 1953	Fully Compliant	The proposed action does not occur on submerged lands and no construction is expected on submerged lands.
Wild and Scenic River Act of 1968	This Act is not applicable.	No designated wild and scenic rivers are located within study area.
EO 11514, Protection and Enhancement of Environmental Quality	Fully Compliant	The objectives of the proposed action are focused on life, health, safety, and environmental protection.
EO 11593, Protection and Enhancement of the Cultural Environment	Fully Compliant	The SCCL study is in compliance with this E.O.
EO 11988, Floodplain Management	Fully Compliant	The purpose of this E.O. is to discourage federally induced development of floodplains. This project would essentially elevate structures above the floodplain, thereby improving floodplain management.
EO 11990, Protection of Wetlands	Fully Compliant	The proposed project would not take place in any wetlands.
EO 12962, Recreational Fisheries	Fully Compliant	The proposed action is not expected to have any impact to recreational fisheries in or near the study area.
EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations	Fully Compliant	A full environmental justice analysis was completed (Appendix A-2 and the project would not disproportionately adversely affect any minority or low-income population.
EO 13007, Indian Sacred Sites	This Act is not applicable.	This EO is directed toward executive branch agencies with statutory or administrative responsibility for the management of federal lands. The proposed action would not affect Department of Defense-owned or USACE- managed lands.
E.O. 13045, Protection of Children from Environmental Health Risks and Safety Risks	Fully Compliant	The proposed action is not expected to have environmental or safety risks that may disproportionately affect children.

Law, Policy and Regulations	Status	Comments
E.O. 13089, Coral Reef Protection	Fully Compliant	Coral reefs are not affected.
EO 13122, Invasive Species	Fully Compliant	The USACE would prepare a nuisance and exotic vegetation control plan during the project's PED phase to ensure any construction activities would prevent or reduce establishment of invasive and non-native species within the study area.
EO 13175, Consultation and Coordination with Indian Tribal Governments	Fully Compliant	In meeting its Federal trust responsibility, the USACE engaged in government-to-government consultation with Tribes via letter on June 10, 2019, to consult on this Undertaking in anticipation of developing a PA. Consultation with Tribes would continue throughout PED.
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds	Fully Compliant	The proposed action would not adversely affect migratory bird species.
Advisory Circular 150/5200-33A – Hazardous Wildlife Attractants on Near Airports	Fully Compliant	The closest airport, the Harry P. Wouldiams Memorial Airport is approximately 7 miles from the closest proposed project feature. SCCL project would not impact any airports or promote increased wildlife, especially bird use, near or on any airports.
EO 13807, Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects, 15 August 2017.	Fully compliant. The USACE would continue to comply with this EO, also referred to as One Federal Decision (OFD) throughout the planning process.	The USACE determined the project is a major infrastructure project and is eligible for inclusion on the OFD dashboard. The USACE uploaded the dashboard with project milestone dates. The USACE and other federal agency partners have not missed any established milestones and therefore are in full compliance with this EO (Appendix A-8).

6.2.10 Compliance with Louisiana Statutes Permits, Entitlements, and Certifications

National Pollutant Discharge Elimination System, Section 402 (NPDES) permits required under the CWA may be necessary for the construction (non-point source runoff) of project features, depending on means and methods of construction. The USEPA has delegated this program to the LADEQ for implementation. Nonstructural improvements would need to be authorized by NPDES permits. At this time, a NPDES permit would not be required for the operation of the other SCCL features, as the project does not involve the discharge of pollutants. All required permits, including underground injection control permits, and/or modifications to existing permits would be acquired prior to construction activities.

6.2.11 Compliance with Applicable Water Quality Standards and Permitting Requirements

The SCCL is not expected to significantly affect the compliance of watercourses, lakes, or wetlands with applicable water quality criteria. If potentially adverse effects are observed or predicted, longer-term impacts to water quality associated with the operation of project features would be addressed through operational monitoring and adaptive management actions.

6.2.12 Coastal Zone Management Act of 1972

The CZMA requires "each federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner to the maximum extent practicable, consistent with approved state management programs." In a letter dated October 1, 2019, the USACE submitted a preliminary Coastal Zone Consistency Determination (per 15 C.F.R. § 930.35) to the LDNR. The LDNR provided initial comments by letter dated October 23, 2019. (Appendix A-7: Coastal Zone Determination). The LDNR provided comments addressing the final planning stage and the NED Plan on October 14, 2020 (Appendix A-7: Coastal Zone Determination). The LDNR stated this project is “consistent with the LCRP in accordance with Section 307 (c) of the Coastal Zone Management Act of 1972, as amended. Should there be any future modifications to this project which have the potential to affect any land use, water use, or natural resource of the Louisiana coastal zone, please provide additional consistency determinations as appropriate to ensure compliance with the LCRP.”

6.2.13 Other Environmental Compliance Requirements

Advisory Circular 150/5200-33A – Hazardous Wildlife Attractants on Near Airports

The advisory circular provides guidance on locating certain land uses having the potential to attract hazardous wildlife to or in the vicinity of public-use airports. The circular provides guidance on wetlands in and around airports and establishes notification procedures if reasonably foreseeable projects either attract or may attract wildlife.

In response to the advisory circular, the U.S. Army, as well as other Federal agencies, signed a memorandum of agreement (MOA) with the Federal Aviation Administration to address aircraft-wildlife strikes. The MOA establishes procedures necessary to coordinate their missions to more effectively address existing and future environmental conditions contributing to aircraft-wildlife strikes throughout the U.S.

The proposed flood proofing measures at the Harry P. Williams Memorial Airport would not promote wetland habitat growth, and therefore would not attract or promote increased wildlife, especially bird use, near or on the airport.

Engineer Regulation 1105-2-100

In addition to the resources listed in Table 6-2, the USACE planning guidance (ER 1105-2-100, 1983) identifies other resources USACE needed to take into account during project planning (Table 6-2).

Table 6-2. ER 1105-2-100 Resources

Resource	Possible Project Effects	Reasons
Life	Positive effect	Added flood risk reduction
Health	Positive effect	Added flood risk reduction
Safety	Positive effect	Added flood risk reduction
Long term productivity	Positive effect	Added confidence with additional flood risk reduction
Energy requirements	Short term minor effect; no long term effect	Localized, temporary construction fuel needs
Energy conservation	Positive effect	Less energies required for future flood fight requirements

6.3 RELATIONSHIP TO SHORT-TERM USES AND LONG-TERM PRODUCTIVITY (ON ALL RESOURCES)

Construction activities would temporarily disrupt, wildlife, and human recreational use in the immediate vicinity of a given construction site. Construction activities would likely provide positive, short-term economic opportunities and a few jobs for the surrounding communities. Overall, the long-term health and productivity of the ecosystem is anticipated to remain stable with implementation of the proposed project. Flood risk reduction would increase under the preferred alternative (Alternative 1); therefore, short-term human use impacts would be offset by long-term increases in productivity.

6.4 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT TO RESOURCES (ON ALL RESOURCES)

Irreversible commitments are those that cannot be reversed, except perhaps in the extreme long run (Shipley, 2010). Simply stated, once the resource is removed, it can never be replaced. This study is in the planning stage. Money has been expended to complete this planning document and pre-project monitoring. No construction dollars, considered irreversible, have been expended for the study.

Irretrievable commitments are those lost for a period of time (Shipley, 2010). Construction activities of any of the considered action alternatives would temporarily disrupt natural resource productivity. The construction activities signal an irretrievable loss in exchange for the benefits of the habitat improvements.

6.5 RELATIONSHIP TO PLANS AND MASTER PLANS

Table 6-3 shows the relationship of the SCCL study and study area land use plans.

Table 6-3. Project Relationship with Local Land Use Plans

Title	Owner	Date	Purpose	Project Relationship
St. Mary Levee District Master Plan	St. Mary Parish	2010	The Plan identifies parish hurricane protection, backwater flooding, and related needs such as saltwater intrusion prevention.	Both plans identify actions to reduce flood impacts and enhance economic resiliency through active management of the floodplain. The SCCL NED Plan supports and is in alignment with the master plan.
Breaux Bridge Comprehensive Long-Range Resiliency Plan	Breaux Bridge, LA	2012	A plan to use infill development in targeted areas to manage growth and ensure long-term resilience.	The proposed project supports this plan with flood impact resiliency and floodplain management. The NED Plan proposes elevating residential structures and floodproofing nonresidential structures. These features support increased resiliency this master plan.
Iberia Parish Hurricane Protection Master Plan	Iberia Parish	2012	Comprehensive plan to provide protection from flooding, saltwater intrusion, tidal and storm surges associated with tropical storms and hurricanes for the lands and residents of Iberia parish.	Both plans identify actions to reduce flood impacts and enhance economic resiliency through active management of the floodplain. The SCCL NED Plan supports and is in alignment with the master plan.
Louisiana's Comprehensive Master Plan	Coastal Protection and Restoration Authority of Louisiana.	2017	Following Hurricanes Katrina and Rita in 2005, the Louisiana Legislature created the CPRAB and tasked it with coordinating the local, state, and Federal efforts to achieve comprehensive coastal protection and restoration. To accomplish these goals, CPRAB was charged with developing a master plan to guide our work toward a sustainable coast.	Both plans identify actions to reduce flood impacts and enhance economic resiliency through active management of the floodplain. The SCCL NED Plan supports and is in alignment with the master plan. Measures screened from SCCL study but included in the Master Plans would further reduce localized reoccurring damages and if implemented would provide additional resilience to flood events.
Restoring the Mississippi River Delta	Restore the Mississippi River Delta	2018	Recommendations for Coastal Restoration Projects and Programs in Louisiana	While the proposed project does not include ecosystem restoration, it would not impact local or regional restoration efforts or existing habitats. Measures screened from SCCL study but included in the program may further reduce localized reoccurring damages and, if implemented, may provide additional resilience.
Emergency Operations Plans	Parishes	2019	The plans outline frontline emergency operations during storm events such as warning, and evacuation activities.	Management of flood risk is a shared responsibility between local, state, and federal. Although active floodplain management can greatly reduce flood and life safety risk, residual risk remains requiring Emergency Operations Planning. SCCL evaluated RSLR impacts on a primary evacuation route (Hwy 90) and identified locations of frequent inundation. The NED Plan did not substantially reduce the risk to the primary evacuation route. Current Emergency Operations plans support the nonstructural plan by outlying other required flood risk reduction measures that frontline emergency operations during storm events such as warning, and evacuation activities. It is recommended that local and state officials consider the SCCL evacuation route assessment to determine if changes to storm warning and evacuation activities is warranted.
Morgan City and Berwick: Building the Foundation for a New Economy along the Atchafalaya River	Urban Land Institute.	2018	This Draft Supplemental FR/EIS outlines a series of recommendations whose implementation requires strong community buy-in and leadership for Berwick and Morgan City, LA.	This plan and the SCCL project strive to protect a thriving, unique, and prosperous region. The Washington based Urban Land Institute's Land Use Plan includes a description of its long term planning goals. The SSCL project has a 50-year project economic period of analysis.

6.6 INDIRECT EFFECTS

Indirect effects, as defined by the CEQ regulations, are "caused by the proposed action and occur later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystem" (40 CFR 1508.8). Indirect effects differ from direct impacts associated with the construction and operation of the proposed project and are caused by an action or actions having an established relationship or connection to the proposed project. Indirect effects can be linked to direct effects in a causal chain and extended as indirect effects producing further consequences.

This document identified in previous sections the NED plan potential effects and issues associated with implementing the NED plan, by documenting the direct and indirect effects of the proposed action on environmental resources. The USACE did not identify any significant impacts. The following indirect effects the USACE assumed may occur:

- Flood resiliency may slow or reverse a regional population decline.
- Moving structures above the floodplain may reduce damages normally resulting in hazardous spills, pollution, and expensive clean-up costs.
- There may be short-term impacts to tax revenue throughout the region during construction.

6.7 CUMULATIVE IMPACTS

Cumulative impacts are defined as those impacts resulting from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes the actions. Representative past, present, and future regional projects were utilized in the cumulative impacts analysis.

Cumulative effects result from the proposed action when added to other past, present and reasonably foreseeable projects or actions. Cumulative effects are not caused by a single project but include the effects of a particular project in conjunction with other projects (past, present and future) on the particular resource. Cumulative effects are studied to enable the public, decision-makers and project proponents to consider the "big picture" effects of a given project on the community and the environment. In a broad sense, all impacts on affected resources are probably cumulative; however, the role of the analyst is to narrow the focus of the cumulative effects analysis to important issues of national, regional and local significance (CEQ, 1997).

The CEQ issued a manual entitled *Cumulative Effects Under the National Environmental Policy Act* (CEQ, 1997). This manual presents an 11-step procedure for addressing cumulative impact analysis. The cumulative effects analysis for the SCCL project followed these 11 steps, shown in Figure 6-1. The cumulative effects analysis concentrates on whether the actions proposed for this study, combined with the impacts of other projects, would result in a significant cumulative representative past, present, and future regional projects were utilized in the cumulative impacts analysis.

Scoping

1. Identify resources
2. Define the affected area for each resource
3. Define time frame for analysis

Describing the Affected Environment

4. Identify other actions affecting the resources
5. Characterize resources in terms of its response to change and capacity to withstand stress
6. Characterize stresses in relation to thresholds
7. Define baseline conditions

Determining the Environmental Consequences

8. Identify cause-and-effect relationships
9. Determine magnitude and significance of cumulative effects
10. Assess the need for mitigation of significant cumulative effects
11. Monitor and adaptive management, accordingly

Figure 6-1. Approach to Cumulative Effects

6.7.1. Bounding Cumulative Effects Analysis

Cumulative effects analysis requires expanding the geographic boundaries and extending the timeframe to include additional effects on the resources, ecosystems, and human communities of concern.

The USACE's determined geographic boundaries for each resource by the distribution of the resource itself, and the area within that distribution where the resource could be affected by considered action alternatives in combination with other past, present and reasonably foreseeable actions. The primary area considered in the cumulative effects analysis is limited to the study area and an area of influence depending on the resource.

The timeframe for the cumulative effects analysis for each considered resource begins when past actions began to change the status of the resource from its original condition, setting the long-term trend currently evident and likely to continue into the reasonably foreseeable future. The timeframe for this analysis began in the early 1800s when the region began to be altered by non-indigenous settlers and ends in 2075 (end of 50-year period of analysis for the study).

6.7.2. Reasonably Foreseeable Future Actions and Conditions

Cumulative impacts would be the incremental direct and indirect effects of not taking action to address hurricane storm surge damage risk reduction on the human, water and natural environmental resources, in addition to the direct and indirect impacts of other past, present and reasonably foreseeable future actions (40 CFR § 1508.7) on these important resources. In the FWOP conditions, the following human, water and natural environmental important resources would continue to be at risk.

6.7.3. Human Environment

- Population is declining in the area and households are holding steady in the FWOP.
- People, households and other structures in the study area in the year 2075 would remain at risk of hurricane storm surge damage.
- Transportation infrastructure would be more susceptible to damages resulting from hurricane storm surge events due to expected RSLR and loss of coastal wetlands.
- Infrastructure would remain at risk and continue to experience reduced access due to hurricane storm surge damage and loss of coastal wetlands.
- Community and regional growth would remain at risk of continued hurricane storm surge damage.
- Tax revenues and property values would remain at risk due to continued hurricane storm surge damage.
- Continued erosion, fragmentation and eventual loss of coastal wetlands.
- Expected higher flood insurance premiums would be expected to increase the cost of property ownership and result in correspondingly lower market values.
- Continued or increased risk of damage to residential and non-residential structures resulting in temporary and/or permanent relocation of populations would negatively affect the community cohesion in many communities.
- Continued temporary displacement of minority and/or low-income populations because residents within the area would remain vulnerable to flooding from hurricane storm surge and may be forced to relocate to areas with risk reduction measures in place.
- Continued higher risks of damage from hurricane storm surge would manifest itself in higher premiums for flood insurance under the NFIP.
- Continued shoreline recession, subsidence, and land loss would result in the movement of unstable sediments and would undermine man-made structures, especially the extensive oil and gas pipelines and related structures in this "working coastline".
- As a result of structure elevation life safety risk reduction is expected to have minor positive impacts. Life safety risk reduction is specific to residents who shelter in place and during events not requiring evacuation.

6.7.4. Water Environment

- Existing hydrologic alterations would continue to impact water levels and salinities and continue influencing land loss at similar or increased rates.
- As sea levels rise, natural drainage pattern flow paths would remain unchanged but drainage times would increase.
- Continued salt water intrusion and inundation during hurricane storm surge events.
- Continued erosion by wave and current action resulting in continued shoreline erosion of most channels, lakes, and the gulf.

6.7.5. Natural Environment

- Degradation, fragmentation and continued loss of soil resources, especially coastal wetlands would continue into the FWOP condition. The Louisiana Coastal Study (USACE, 2004) estimated coastal Louisiana would continue to lose land at a rate of approximately 6,600 acres per year over the next 50 years. It is estimated an additional net loss of 328,000 acres may occur by 2050, which is almost 10 percent of Louisiana's remaining coastal wetlands. More recently, Couvillion et al (2013) estimated that between 2010 and 2060, coastal Louisiana would show a net change of -519,119 acres the Teche/Vermilion basin with a net change of -16,556 acres. However, wetland soil losses would be offset to some extent by restoration projects implemented through other programs.
- Continued increases in RSLR could increase saltwater intrusion and exacerbate ongoing conversion of existing estuarine wetlands to shallow open water.
- Impacts to cultural and historic resources in coastal Louisiana would continue as a result of both natural processes and cultural modifications of the landscape.
- Recreational infrastructure and consumptive recreational opportunities would remain vulnerable to damage from hurricane storm surges.
- Continued conversion of existing vegetated wetlands used as foraging, nesting, and over-wintering habitat to open water habitats.
- Reduction in overall species diversity and abundance as well as loss of estuarine nursery, foraging, refugia, and other estuarine aquatic habitats.
- Continued bankline erosion with sloughing, fragmentation and continued degradation of shorelines.
- Continued encroachment of salinity into fresher areas of brackish and freshwaters.
- Continued habitat switching by organisms due to continued fragmentation, degradation and loss of transitional estuarine habitats due to increasing RSLR, subsidence, shoreline erosion, and other land loss drivers.
- Loss of existing transitional estuarine habitats would further stress species that are dependent on these habitats for all or a part of their life cycle.

The FWOP risks to the important resources in the human, water and natural environment could be offset, to some undetermined degree, by other hurricane storm damage risk reduction projects and ecosystem restoration efforts. The USACE used other assumptions key to the formulation and recommendation, including those related to analytic models used in the study.

"Reasonably foreseeable actions" were defined as actions or projects with a reasonable expectation of actually happening, as opposed to potential developments expected only on the basis of speculation. In addition, the following proposed present actions were considered for this cumulative impacts analysis:

- Lake Pontchartrain and Vicinity - Lake Pontchartrain and Vicinity, LA - General Reevaluation Report. The Lake Pontchartrain and Vicinity project is located between the Mississippi River on the south, Lake Pontchartrain on the north and Lake Borgne on the east. The project includes features in four parishes (St. Charles, Jefferson, Orleans, and St. Bernard) and provides 1 percent risk reduction for hurricane and storm risk to a portion of the greater New Orleans area. Due to the combined effects of subsidence, settlement, consolidation, and potential sea level rise, the levee system would not provide the designed level of risk reduction in the future, resulting in increased risk to life safety, flood damages and human health safety. The study investigates potential measures to restore the authorized level of risk reduction.
- The Amite River and Tributaries –Comprehensive Study East of the Mississippi River Louisiana. The study area includes the Amite River Basin, encompasses an area of approximately 3,450 square miles consisting of eight Louisiana parishes (East Feliciana, St. Helena, East Baton Rouge, Livingston, Iberville, Ascension, St. James, and St. John the Baptist), Maurepas Lake, and four Mississippi counties (Amite, Wilkinson, Franklin, and Lincoln). Over three-fourths of the study area lies in the parishes of southeastern Louisiana, located east of the Mississippi River and north of Lake Maurepas. The upper one-fourth of the study area's drainage area lies in the southwestern Mississippi counties and is home to over 500,000 residents. Due to the August 2016 flooding, the entire study area is being reevaluated to determine whether additional improvements for flood control are recommended with particular reference to the Amite River, Bayou Manchac, Comite River, and their tributaries.
- Upper Barataria, Louisiana Feasibility Study - The study area includes communities in the following seven southeast Louisiana parishes: Ascension, Assumption, Jefferson, Lafourche, St Charles, St. James, and St. John the Baptist Parishes. The Study Area is bounded on the north and east by the Mississippi River and Tributaries Project, Mississippi River Levee, on the west by Bayou Lafourche, and on the south study area extends slightly past U.S. Highway 90. The Upper Barataria Basin is part of the larger Barataria Basin watershed covering approximately 760 square miles and characterized by low, flat terrain with numerous navigation channels, drainage canals, and natural bayous that drain into Lake Salvador and eventually the Gulf of Mexico. The entire study area has been declared a federal disaster area nine times in the past 30 years due to flood damages from storms. The feasibility study is reevaluating measures to reduce rainfall, tidal, and hurricane flooding to protect residential and commercial structures, major transportation routes, and many other commercially and culturally significant places and activities vital to the economy of the region.
- The West Shore Lake Pontchartrain project is located in southeast Louisiana on the east-bank of the Mississippi River in St. Charles, St. John the Baptist, and St. James Parishes in Southeast LA. The West Shore Lake Pontchartrain Chief Report was published in June 2016 and the project has been included in the BBA of 2018. The $760 million project is approximately 18.5 miles in

length and includes 17.5 miles of levee, 1 mile of T-wall, 4 pumping stations, two drainage structures, and approximately 35 utility relocations. The project would also provide localized risk reduction measures focused in St. James Parish. The project would include mitigation to offset unavoidable environmental impacts.

- The Southwest Coastal Louisiana project would provide nonstructural hurricane and storm surge damage risk reduction measures in the 4,700 square mile study area located in Calcasieu, Cameron, and Vermilion Parishes in southwest Louisiana.

The NED plan proposes implementing nonstructural measures across the study area to reduce coastal storm surge damages to 2,240 residential structures, commercial structures, public buildings, and warehouses through the combined voluntary elevation of residential structures and dry floodproofing of non-residential structures. To assess the cumulative impacts for the NED plan, the incremental direct and indirect impacts of implementing the NED plan, as detailed in Section 4 above, are considered together with other past, present and reasonably foreseeable future nonstructural risk reduction projects identified and described below. Table 6-4 summarizes the cumulative impacts[1].

6.7.6. Reasonably Foreseeable Ongoing Programs

It is reasonably foreseeable that the FEMA hazard mitigation assistance (HMA) (http://www.fema.gov/hazard-mitigation-assistance) grants programs would continue to provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. Currently, FEMA administers the following HMA grant programs:

- Hazard Mitigation Grant Program (HMGP) assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available to implement projects in accordance with State, Tribal, and local priorities.
- Pre-Disaster Mitigation (PDM) provides funds for hazard mitigation planning and to implement mitigation projects before disasters. The program goal is to reduce overall risk to the population and structures, while at the same time, also reducing reliance on Federal funding from disaster declarations.
- Flood mitigation assistance (FMA) provides annual funds so that measures can be taken to reduce or eliminate risk of flood damage to buildings insured under the NFIP.

The 2017 State Master Plan recommends a comprehensive nonstructural program as part of its strategy to reduce the flood risk for Louisiana citizens.

The *2017 State Master Plan's Appendix E3 Nonstructural Implementation Strategy* includes the following nonstructural strategies:

- floodproofing of residential and commercial properties, and
- elevation of residential properties.

In addition, programmatic measures such as land use planning, building codes, and education that can reduce risk to future buildings within communities would be integral to the nonstructural program (source: http://coastal.la.gov/our-plan/2017-coastal-master-plan/ accessed October 24, 2019).

Following Hurricanes Katrina, Lili, Rita, Gustav, Ike, and Issac, many residents were required to meet certain building requirements to meet floodplain management ordinances. Some individuals met these building requirements at personal expense. Many others utilized the FEMA HMA (http://www.fema.gov/hazard-mitigation-assistance) grants programs (including: HMGP, PDM and FMA programs) to provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from past, present and future disaster damages in Louisiana.

6.7.7. Nonstructural Risk Reduction Measures throughout the Study Area

Past and Present Actions

Section 2 discusses the existing condition of each resource by describing the present condition and providing historical context (e.g., the past condition) for how the resource was altered to the current conditions. The USACE used information from field surveys, discussions with project sponsor and subject matter experts, scoping comments, and literature searches to assess the past and existing conditions of the resource and to identify present and reasonably foreseeable future actions.

Ongoing commerce such as tourism, fisheries, petroleum extraction and processing, and shipping would continue to be major activities in the study area. Development and ongoing improvements to these industries are taking place and would continue into the future.

Within the study area the only known Federal program addressing reduction in damages from hurricane storm surge events is FEMA's Hazard Mitigation Assistance, as expressed in the FEMA Federal Insurance and Mitigation Administration policy guidance. The key purpose of the Hazard Mitigation Grants Program is to ensure that the opportunity to take critical mitigation measures to reduce the risk of loss of life and property from future disasters is not lost during the reconstruction process following a disaster. The HMGP funding is available, when authorized under a Presidential major disaster declaration, in the areas of the State requested by the Governor. Federally-recognized tribes may also submit a request for a Presidential major disaster declaration within their impacted areas (see http://www.fema.gov/medialibrary/assets/documents/85146).

The amount of HMGP funding available to the Applicant is based on the estimated total Federal assistance, subject to the sliding scale formula outlined in Title 44 of the CFR Section 206.432(b) that FEMA provides for disaster recovery under Presidential major disaster declarations. As described in greater detail at the above referenced website, the following project types are eligible under the HMA programs:

- Property Acquisition and Structure Demolition;
- Property Acquisition and Structure Relocation;
- Structure Elevation;
- Mitigation Reconstruction,
- Dry Floodproofing; and
- Wet Floodproofing.

A total of 2,240 eligible structures are within the study area. Of these, 1,790 residential structures, 233 commercial, 32 public, and 185 industrial are within the 25-year floodplain. Many of these structures are located on naturally higher elevations. It is reasonably foreseeable that many of these self-reliant residents would continue to stay in the area and raise their structures or take other measures to reduce hurricane storm surge damages.

6.7.8. 50 year Cumulative Effects by Resource

This analysis considers known past, present, and reasonably foreseeable future nonstructural hurricane storm damage risk reduction projects over a 50-year period of analysis from 2025 to 2075. Table 6-4 provides the cumulative effects analysis including the past, present and reasonably foreseeable actions that might impact each resource category identified to have an incremental cumulative effect. If a resource was not identified to have a cumulative effect, then this resource was not discussed in detail. The cumulative effects analysis discusses future conditions of the No Action alternative (without project) and with the NED Plan discussed in whole, as an alternative, unless otherwise noted.

Table 6-4. Summary of Cumulative Impacts

Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Nonstructural 0-25 year Floodplain Plan*
Water	US & LA & SA: Flows and water levels respond to and are impacted by natural conditions such as hurricane storm surge and man-made conditions. Subsidence and eustatic sea level rise cause landward movement of marine conditions into estuaries, wetlands and fringing uplands.	US & LA: Increased flows and water levels associated with increased runoff due to increasing urbanization and wetland loss. Rate of RSLR increasing over historic conditions. SA: Water control structures operated both passively and actively. Virtually all hydrologic management focuses on controlling salinity and minimizing tidal fluctuations by constructing and operating levees, weirs, and a variety of gated structures. 1990 inventory identified 174 individual water control structures in the study area.	US & LA & SA: Increased hurricane storm surges; increased flows and water levels associated with increase urbanization and associated runoff and increased wetland loss. Rate of RSLR increasing over historic conditions. Existing and authorized structural and nonstructural hurricane storm surge damage risk reduction projects provide risk reduction. SA: Continued disjointed and uncoordinated operation of water control structures. There are no identified existing or authorized for construction risk structural or nonstructural risk reduction measures in SA.	US & LA: Increased hurricane storm surges; increased flows and water levels associated with increased urbanization and associated runoff and increased wetland loss. Rate of RSLR increasing over historic conditions. Existing and authorized structural and nonstructural hurricane storm surge damage risk reduction projects provide risk reduction. SA: Total level of project-induced impact would be relatively minor and in addition to other existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects.
Water Quality and Salinity	LA & SA: Clean Water Act of 1977, NEPA of 1969, Coastal Zone Management Act, and Estuary Protection Act and institutional recognition to restore and protect water bodies, especially with respect to point sources. Non-point sources still unregulated. LA & SA: Increasing human development adversely impacts water quality. Salinity levels increase inland due to salt water intrusion, due in part to wetland loss, channelization,	US & LA & SA: Continued institutional recognition. Increasing human development, agriculture and oil & gas exploration and industrialization result in increased potential for water quality problems and saltwater intrusion. SA: coastal wetland loss results in loss of water purification by wetlands. Channels and oil & gas exploration canal continue to provide conduit for saltwater intrusion and coastal land loss.	US & LA & SA: Continued institutional recognition. Increasing human development, agriculture and oil & gas exploration and industrializetion result in increased potential for water quality problems and saltwater intrusion. These water quality impacts offset by existing and authorized for construction ecosystem restoration projects. SA: coastal wetland loss results in loss of water purification by wetlands. Channels and oil & gas	US & LA: Continued institutional recognition. Increasing human development, agriculture, channelization and oil & gas exploration and industrialization continue to result in increased potential for water quality problems and saltwater intrusion. These water quality impacts offset by existing and authorized for construction ecosystem restoration projects. SA: The NED Plan would reduce water quality impacts associated with flooding from

Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Nonstructural 0-25 year Floodplain Plan*
	and oil and gas exploration canals.		exploration canal continue to provide conduit for saltwater intrusion and coastal land loss.	storm surge events. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects.
Coastal Shorelines	US: Institutional recognition of coastal barrier resources. Beach shorelines continue to erode as sea level rises and, in many instances, subsidence continues. Losses offset by federal, state, and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. Losses offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: Gulf coastal shorelines and interior waterbody shorelines continue to erode due to natural and man-induced causes.	US: Institutional recognition of coastal barrier resources continues. Beach shorelines continue to erode as sea level rises and subsidence continues. Losses offset by federal, state, and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and their state and local efforts LA: beach shorelines continue to erode as sea level rises and subsidence continues. Losses offset by federal, state, and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. Losses offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts.	US: Institutional recognition of coastal barrier resources continues. Losses offset by federal, state, and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. Losses offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts	US: Institutional recognition of coastal barrier resources continues. Beach shorelines continue to erode as sea level rises and, in many instances, subsidence continues. These impacts offset by federal, state and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. Losses offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: NED Plan has no significant direct, indirect or cumulative impacts on coastal shorelines.

Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Nonstructural 0-25 year Floodplain Plan*
Population and Housing	Risks of hurricane storm surge impacts continue to those not provided risk reduction by structural or nonstructural risk reduction measures. United States (US): Population and households increasing. Louisiana (LA): population in 1970 estimated at 3.645 million. Risks of hurricane storm surge impacts to those not provided risk reduction by structural or nonstructural risk reduction measures. SA: 1970 populations and number of households in St Mary, St, Martin, & Iberia Parishes is 196,680 with 57.2 thousand households.	Risks of hurricane storm surge impacts continue to those not provided risk reduction by structural or nonstructural risk reduction measures. US: Population and households increasing. LA: 2015 populations increasing to 4,605 million. Continued coastal land loss and conversion to open water and loss of forested wetlands. St Mary, St, Martin, & Iberia Parishes 2019 population 259,918 with 96.2 thousand households.	Risks of hurricane storm surge impacts continue to those not provided risk reduction by structural or nonstructural risk reduction measures. US: Population and households increasing. LA: Increasing population and households in Louisiana. Continued coastal land loss and conversion to open water and loss of forested wetlands. SA: Increases population and households in Mary, St, Martin, & Iberia Parishes. Households likely continue. Risk of hurricane storm surge damages continue. Continued loss of brackish and saline marsh habitats.	US: Population and households increasing. LA: Increasing populations and households. Risks of hurricane storm surge impacts continue to those not provided risk reduction by structural or nonstructural risk reduction measures. SA: Hurricane storm surge related risks reduced for individual households and people located in the 25 year floodplain and in structures that volunteer to participate in nonstructural risk reduction measures. People and households associated with those structures not included in the proposed voluntary nonstructural risk reduction measures would continue to be at risk from hurricane storm surge risk reduction.
Employment, Business, and Industrial Activity	The leading employment sectors are education, healthcare, petroleum production, and petrochemical refining. Other significant employment sectors include education, manufacturing, accommodations and social services, and retail trade. Employment for the region as a whole grew from 1970 through 2000.	Employment growth was steady and is reflected in the population estimates previously described.	Employment is expected to continue to follow the same trend in the study area. However, businesses would face a higher risk of closing periodically due to damages sustained from hurricane storm-surge.	Would lower the risk that hurricane storm-surge damage would cause the businesses included in the recommended plan. This lower risk could shorten the amount of time businesses would need to close following a hurricane.
Public Facilities and Services	The Ports of Morgan City and Iberia are key centers for international trade and is among the top busiest ports in the	The Ports of Morgan City and Iberia are key centers for international trade and is among the top busiest ports in the	FWOP conditions would include a greater potential for permanent displacement of public facilities and services due	Would reduce risk of hurricane storm surge-related damages for public facilities and services in the area thereby reducing the

Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Nonstructural 0-25 year Floodplain Plan*
	nation.	nation.	to hurricane storm surge events. Public facilities and services are expected to grow with the needs of the population and would follow population growth trends.	number of days a structure is unavailable for use and minimizing the inconvenience to the general public.
Transportation	The transportation infrastructure includes major roads, highways, railroads, and navigable waterways that have developed historically to meet the needs of the public. Highway 90, an east-west thoroughfare that crosses the central part of the area and is a primary route for hurricane evacuation and post-storm emergency response.	The transportation infrastructure includes major roads, highways, railroads, and navigable waterways that have developed historically to meet the needs of the public. Highway 90, an east-west thoroughfare that crosses the central part of the area and is a primary route for hurricane evacuation and post-storm emergency response.	Portions of Highway 90 and other highways and local roads would continue to be periodically damaged by hurricane storm surge.	Portions of Highway 90 and other highways and local roads would continue to be periodically damaged by hurricane storm surge.
Tax Revenue and Property Values	Tax revenues from property taxes tend to rise over time with the increase in property values.	Property values in the low-lying areas are likely not rising in value at the same rate as comparable properties facing a lower risk of sustaining hurricane storm-surge damage.	FWOP conditions would include lower tax revenues as property values decline due to higher risk of damage from hurricane storm surge events over time. Higher risk of damage from hurricane storm surge would manifest itself in higher premiums for flood insurance under the NFIP: higher premiums are expected to increase the cost of property ownership and result in correspondingly lower market values	For the properties included in the recommended plan, property values would stabilize as the higher risk of damage from hurricane storm surge is arrested and reduced.
Community Cohesion	US, LA and SA: Community cohesion is based on the characteristics that keep the members of the group together long enough to establish meaningful interactions, common institutions, and	US, LA and SA: Due to the absence of hurricane storm surge risk reduction measures, and the resulting direct impacts to existing structures, local populations are often forced to evacuate and/or relocate for	US, LA and SA: Due to the absence of hurricane storm surge risk reduction measures, and the resulting direct impacts to existing structures, local coastal populations, projected to increase in the future, are	US, LA and SA: Storm surge risk reduction measures could temporarily affect community cohesion due to the noise and fugitive dust from construction activities, the temporary displacement and relocation of

Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Nonstructural 0-25 year Floodplain Plan*
	agreed upon ways of behavior. Many areas across the country, state and in the study, area are comprised of communities with a long history and long-established public and social institutions including places of worship, schools, and community associations. In 2005 with Hurricane Rita, and again in 2008 with Hurricane Ike, communities in study area were inundated by storm surge and social institutions were impacted and affected community cohesion.	significant time periods, thereby significantly disrupting temporarily, and in some instances, permanently, community cohesion.	often forced to evacuate and/or relocate for significant time periods, thereby significantly disrupting temporarily, and in some instances, permanently, community cohesion. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects.	residents during construction, and disruption of businesses during construction. Furthermore, non-residential structures that serve as meeting places for the community could become temporarily unavailable during Project implementation. The nonstructural plan would provide positive benefits to the community and its cohesiveness by reducing the risk of storm surge damage resulting in fewer evacuations or permanent displacement. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects.
Community and Regional Growth	Growth in the study area has been largely steady and follows population trends	Residents currently living in low lying areas face the prospect of relocating due to the high risk of hurricane storm surge damage.	Income growth and associated community and regional growth are expected to follow trends in national income, local employment, household formation, and the demand for public facilities and services. There would also be a higher potential for unstable or disrupted community and regional growth due to increasing risk of damage from storm surge events.	Would include reduced risk of hurricane storm surge-related damages for those low-lying structures located in the 25 year floodplain thus reducing overall social vulnerability and preserving growth opportunities for communities in the region and enhancing the potential for long-term growth and sustainability.
Recreation Resources	US, LA and SA: Recreational features and opportunities vary	US, LA and SA: Federal and State agencies are major	US, LA and SA: The continued loss of wetlands/marshes and	US, LA and SA: By elevating residential recreational

Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Nonstructural 0-25 year Floodplain Plan*
	throughout the coastal zone, habitat and culture playing significant roles in the diversity of activities. From the games and competitions of Native American to the influence of diverse immigrant cultures, traditional recreation in Louisiana has been a product of its people.	providers of recreational opportunities throughout the country and State of Louisiana. There are one Wildlife Refuges and Conservation Areas in the Study Area, and two State parks. In addition to the high quality recreational fishing and hunting in the parks in the region, several lakes and inland marshes offer opportunities for birding, hunting and catching both freshwater and saltwater species.	habitat diversity affects recreational opportunities. Storm surge and saltwater could have a negative impact on freshwater forests and habitats and could reduce recreational resources (e.g., fishing, hunting, bird watching, and other). In general, further degradation of area marshes would continue and its associated negative impacts on recreation activities would increase. Additionally, recreational infrastructure would remain vulnerable to surges. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects.	structures, such as camps, damage from storm surge is less likely to occur. Additionally, elevated structures should create less debris that must be removed following a storm surge event. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects.
Other Social Effects	US: Severe storm surge events threaten the health and safety of residents living in coastal areas. Loss of life, injury, and post flood health hazards may occur in the event of catastrophic flooding. LA and SA: The study area was severely impacted by Hurricane Rita in 2006 and Hurricane Ike in 2008. When facilities that provide critical care or emergency services are impacted by storm surge events, residents are at an even greater risk for experiencing	US, LA and SA: Other Social Effects that storm surge has on communities include impacts to health and safety, economic vitality, social connectedness, vulnerability and resiliency, and leisure and recreation. Many communities along the eastern seaboard and the gulf coast remain vulnerable to these social effects.	US, LA and SA: Social vulnerability is expected to increase over time if subsidence and sea level rise continue to occur, and the population of coastal communities increases as it is projected to do. The absolute number of socially vulnerable people (e.g., low income, minority, less-educated, and over the age of 65) at risk for storm surge events would increase. This, in turn, may lead to an increased burden placed on local, state, and federal agencies to ensure	US, LA and SA: Cumulative impacts include reducing the risks associated with damages to housing units, public facilities, and commercial structures during storm events as well as improving the health and safety of residents living within the study area. The study area's social vulnerability would be reduced under this alternative with the possible exception of populations unwoulding to participate or unable to participate in the Project due to ineligible Project costs.

Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Nonstructural 0-25 year Floodplain Plan*
	negative health outcomes. Hurricanes Rita and Ike reduced the accessibility and availability of health facilities and services and required additional first responder (fire and police) protection.		that the most socially vulnerable populations have access to resources before, during, and after flood events. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects as described in more detail in Sections 1.8 and 2.4.2, & 3.7.2.	Reduced social vulnerability leads to the potential for enhanced long-term growth and sustainability. Also, the area would be at a reduced risk of incurring the costs associated with clean-up, debris removal, and building and infrastructure repair as a result of storm surge events. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects as described in more detail in Sections 1.8 and 2.4.2, & 3.7.2
Environmental Justice	US, LA & SA: Institutional recognition of Environmental Justice because of EO 12898 of 1994 and the Department of Defense's Strategy on Environmental Justice of 1995, directing Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations.	US, LA: High poverty rates negatively impact the social welfare of residents and undermine the community's ability to provide assistance to residents in times of need.	US, LA & SA: Institutional recognition of Environmental Justice because of EO 12898 of 1994 and the Department of Defense's Strategy on Environmental Justice of 1995, directing Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations.	US, LA: High poverty rates negatively impact the social welfare of residents and undermine the community's ability to provide assistance to residents in times of need.
Cultural, Historic, and Tribal Trust Resources	US, LA, & SA: Institutional recognition via the NHPA (and others). Historic, cultural, and tribal resources subjected to natural processes and man-made actions.	US, LA, & SA: Continued institutional recognition. Human activities as well as natural processes can potentially destroy historic, cultural, and tribal resources. The loss of land threatens the existence	US, LA, & SA: Continued institutional recognition via the NHPA (and others). Potential loss of historic, cultural, and tribal resources due to natural and human causes. SA: The continued adverse impacts	US & LA: Continued institutional recognition via the NHPA (and others). Potential loss of historic, cultural, and tribal resources due to natural and human causes. SA: Implementing the NED Plan

Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Nonstructural 0-25 year Floodplain Plan*
		and integrity of these resources.	associated with hurricane storm surge and land loss within the SA threatens the existence and integrity of historic, cultural, and tribal resources that may exist within the SA.	could directly, indirectly, and/or cumulatively effect any recorded or unrecorded cultural NRHP-listed or eligible resources that may exist within the project's APE. The SCCL PA (Appendix A-3), dated November 16, 2020, governs USACE's subsequent Section 106 compliance activities. In accordance with the SCCL PA, to the extent any Adverse Effect to identified cultural resources cannot be avoided, such impacts would be mitigated in consultation with stakeholders and following the procedures outlined in the SCCL PA. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects
Aesthetics and Visual Resources	US, LA, & SA: Technical recognition via 1988 USACE Visual Resources Assessment Procedure. Institutional recognition via Wild and Scenic Rivers Act, Louisiana Scenic Rivers Act, Scenic Byways and others. LA & SA: Aesthetic resources negatively impacted by hurricanes Katrina, Rita, Gustav, and Ike	US, LA, & SA: Continued institutional recognition. Visual resources have been destroyed, enhanced, or preserved by human activities and natural processes. LA & SA: Continued wetland loss may have an adverse effect on the visual complexity of the bayous and swamps.	US, LA, & SA: Continued institutional recognition. Continued human population growth and development and other human activities have the potential to destroy, enhance or preserve visual resources. SA: Erosion and land loss could result in the loss of vegetation that may provide a visually complex environment and desirable views and reduce opportunities for viewing wildlife.	US, LA, & SA: Generally, there would be no significant effects on the natural environment. Most effects would be on the human environment. This includes incremental risk reduction achieved by elevating 2,240 residential structures, floodproofing 233 non-residential structures. These impacts would be in addition to other national, state and local existing and authorized for construction structural and

Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Nonstructural 0-25 year Floodplain Plan*
				nonstructural hurricane storm surge damage risk reduction projects
Water Quality and Salinity	LA & SA: Clean Water Act of 1977, NEPA of 1969, Coastal Zone Management Act, and Estuary Protection Act and institutional recognition to restore and protect water bodies, especially with respect to point sources. Non-point sources still unregulated. LA & SA: Increasing human development adversely impacts water quality. Salinity levels increase inland due to salt water intrusion, due in part to wetland loss, channelization, and oil and gas exploration canals.	US & LA & SA: Continued institutional recognition. Increasing human development, agriculture and oil & gas exploration and industrialization result in increased potential for water quality problems and saltwater intrusion. SA: coastal wetland loss results in loss of water purification by wetlands. Channels and oil & gas exploration canal continue to provide conduit for saltwater intrusion and coastal land loss.	US & LA & SA: Continued institutional recognition. Increasing human development, agriculture and oil & gas exploration and industrialization result in increased potential for water quality problems and saltwater intrusion. These water quality impacts offset for construction ecosystem restoration projects. SA: coastal wetland loss results in loss of water purification by wetlands. Channels and oil & gas exploration canal continue to provide conduit for saltwater intrusion and coastal land loss.	US & LA: Continued institutional recognition. Increasing human development, agriculture, channelization and oil & gas exploration and industrialization continue to result in increased potential for water quality problems and saltwater intrusion. These water quality impacts offset by existing and authorized for construction ecosystem restoration projects. SA: The NED Plan would reduce water quality impacts associated with flooding from storm surge events. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects.
Aquatic Resources	US: Institutional recognition of Natural Resources. Wetlands resources continue to be lost to human encroachment and development LA: from 1985 to 2010 increasing coastal land loss of -16.57 mile2 per year SA: from 1985 to 2010 increasing coastal land loss of –0.97 square miles per year Calcasieu Basin; -1.30 mile2 in Mermentau Basin; -0.45 mile2	US: Institutional recognition of Natural Resources continues. Wetlands resources continue to be lost to human encroachment and development LA: from 1985 to 2010 increasing coastal land loss of -16.57 square miles per year SA: from 1985 to 2010 increasing coastal land loss of –0.97 mile2 per year Calcasieu Basin; -1.30 mile2 in Mermentau Basin; -0.45 mile2 per year in Teche-Vermilion	US: Institutional recognition of Natural Resources continues. Wetlands resources continue to be lost to human encroachment and development. These impacts would be offset by existing and authorized for construction ecosystem restoration projects. LA: estimated net change between 2010-2060 under moderate sea level rise scenario is - 2100 km2. These impacts offset by	US: Institutional recognition of Natural Resources continues. Wetlands resources continue to be lost to human encroachment and development. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: estimated net change between 2010- 2060 under moderate sea level rise scenario is -2100 km2. These impacts offset by

Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Nonstructural 0-25 year Floodplain Plan*
	in Teche-Vermilion Basin	Basin	restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: estimated net change between 2010-2060 under moderate sea level rise scenario in Calcasieu/Sabine basin is -146.5 km2; in Mermentau Basin -208 km2; and in Teche- Vermilion Basin -67 km2	restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts. SA: NED Planhas no significant direct, indirect or cumulative impacts on wetlands resources.
Fish and Wildlife Resources	US & LA & SA: Institutional recognition of natural resources and fish and aquatic resources and its habitats. Reduction in fisheries habitat, increased catches, gear improvement, catch regulations, Magnuson-Stevens Fishery Conservation and Management Act and amendments, formation of NMFS and LDWF. About 90% of the world's seafood resources have been depleted in the past century; 38% of the depleted species have declined by more than 90%; 7% of the species of fish studied by researchers have become extinct.	US & LA & SA: Institutional recognition of natural resources and fish and aquatic resources and its habitats. LA: from 1985 to 2010 increasing coastal land loss of -16.57 square miles per year results in loss of coastal estuaries used as fish and aquatic organisms' nursery and foraging habitat. SA: from 1985 to 2010 increasing coastal land loss of – 0.97 mile2 per year Calcasieu Basin; -1.30 mile2 in Mermentau Basin; -0.45 mile2 per year in Teche-Vermilion Basin	US: Institutional recognition of natural resources and fish and aquatic resources and its habitats continues. Fisheries and aquatic resources continue to be adversely impacted due to reduction in fisheries habitat, increased catches, gear improvement, catch regulations. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: continued fish and aquatic organisms' estuarine habitats lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: estimated net change between 2010-2060 under moderate sea level rise scenario in Calcasieu/Sabine basin is -146.5 km2; in Mermentau Basin	US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Fisheries and aquatic resources continue to be adversely impacted due to reduction in fisheries habitat, increased catches, gear improvement, catch regulations. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: continued fish and aquatic organisms' estuarine habitats lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: NED Plan has no significant direct, indirect or cumulative impacts on fisheries or.

Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Nonstructural 0-25 year Floodplain Plan*
			-208 km2; and in Teche-Vermilion Basin -67 km2	
Essential Fish Habitat (EFH)	US & LA & SA: Institutional recognition of decline in EFH quality; passage of Magnuson-Stevens Fishery Conservation and Management Act, as amended, formation of NMFS and LDWF.	US & LA & SA: Institutional recognition of EFH continues. LA: from 1985 to 2010 increasing coastal land loss of -16.57 square miles per year results in loss of coastal estuaries used as transitional estuarine EFH nursery and foraging habitats. SA: from 1985 to 2010 increasing coastal land loss of –0.97 mile2 per year Calcasieu Basin; -1.30 mile2 in Mermentau Basin; -0.45 mile2 per year in Teche-Vermilion Basin results in loss of coastal estuaries used as EFH nursery and foraging habitats.	US: Institutional recognition of EFH continues. LA: continued transitional estuarine EFH lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: continued transitional estuarine EFH lost with estimated net change estimated net change between 2010-2060 under moderate sea level rise scenario in Calcasieu/Sabine basin is -146.5 km2; in Mermentau Basin -208 km2; and in Teche-Vermilion Basin -67 km2	US: Institutional recognition of EFH continues. LA: continued transitional estuarine EFH lost with estimated net change with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: NED Plan has no significant direct, indirect or cumulative impacts on fisheries or aquatic resources. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects
Wildlife Resources	US: Institutional recognition of natural resources and fish and wildlife resources and its habitats. Wetland dependent wildlife populations respond primarily to natural population-regulating mechanisms. Institutional recognition of wildlife and its habitats. Wildlife resources continue to be adversely impacted and lost due to human encroachment and development of wildlife habitats LA: wildlife	US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Continued institutional recognition of wildlife and its habitats. Wildlife resources continue to be adversely impacted and lost due to human encroachment and development of wildlife habitats. LA: wildlife habitats lost from 1985 to 2010 due to increasing coastal land loss of -16.57 square miles per year SA: from 1985 to 2010 increasing	US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Wildlife resources continue to be adversely impacted and lost due to human encroachment and development of wildlife habitats. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: continued wildlife habitats lost with estimated net change between 2010-2060 under	US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Wildlife resources continue to be adversely impacted and lost due to human encroachment and development of wildlife habitats. These impacts would be offset by existing and authorized for construction ecosystem restoration Projects LA: continued wildlife habitats lost with estimated net change between 2010-2060 under

Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Nonstructural 0-25 year Floodplain Plan*
	habitats lost from 1985 to 2010 due to increasing coastal land loss of -16.57 mile2 per year SA: wildlife habitat losses from 1985 to 2010 increasing coastal land loss of –0.97 square miles per year Calcasieu Basin; -1.30 mile2 in Mermentau Basin; -0.45 mile2 in Teche-Vermilion Basin	coastal land loss of –0.97 mile2 per year Calcasieu Basin; -1.30 mile2 in Mermentau Basin; -0.45 mile 2 per year in Teche-Vermilion Basin	moderate sea level rise scenario is - 2100 km2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: estimated net change between 2010-2060 under moderate sea level rise scenario in Calcasieu/Sabine basin is -146.5 km2; in Mermentau Basin -208 km2; and in Teche-Vermilion Basin -67 km2	moderate sea level rise scenario is - 2100 km2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: NED Plan has no significant direct, indirect or cumulative impacts on wildlife resources.
Threatened/Endangered Species and Other Protected Species of Concern	US, LA & SA: The Endangered Species Act of 1973 (ESA), Migratory Bird Treaty Act of 1918 as amended (MBTA), Bald and Golden Eagle Protection Act (BGEPA) and Marine Mammal Protection Act of 1972 (MMPA) help protect the existence of certain species listed under each Act. Listed and protected species habitat is impacted by natural conditions such as hurricane storm surge, saltwater intrusion and subsidence, and man-made conditions such as agriculture, human development and industrialization.	US, LA & SA: continued impacts to listed and protected species habitat by natural conditions such as hurricane storm surge, saltwater intrusion and subsidence, and manmade conditions such as agriculture, human development and industrialization.	US, LA & SA: continued impacts to listed and protected species habitat impacts by natural conditions such as hurricane storm surge, saltwater intrusion and subsidence, and man-made conditions such as agriculture, human development and industrialization.	US & LA: continued impacts to listed and protected species habitat impacts associated with agriculture, human development and industrialization. SA: minimum and temporary project induced impacts such as temporary avoidance of nearby habitat due to noise and construction activity. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects.
Soils	US: Institutional recognition of soil and water resources conservation. Prime agricultural land decreases from 1997 to 2012 LA: land area decreases from 1932 to 2010; SA: land area decreases from 1932 to 2010 with concomitant increase	US: Institutional recognition of soil and water resources conservation. Prime agricultural land decreases from 1997 to 2012 LA: land area decreases from 1932 to 2010 SA consists primarily of wetland type soils and shorelines prone to	US: Institutional recognition of soil and water resources conservation. Prime agricultural land decreases from 1997 to 2012 LA: land area continues to decrease with concomitant increase in shallow open water resulting in greater potential for	US: Institutional recognition of soil and water resources conservation. Prime agricultural land decreases from 1997 to 2012 LA: land area continues to decrease with concomitant increase in shallow open water resulting in greater potential for

Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Nonstructural 0-25 year Floodplain Plan*
	in shallow open water area.	frequent flooding and not suitable for agricultural use. Prime farmland consist of 941,196 acres, or 34.3 percent of the soils in SA	hurricane storm surge damages to human habitations and loss of estuarine marsh habitats. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: land area continues to decrease with concomitant increase in shallow open water resulting in greater potential for hurricane storm surge damages and loss of estuarine marsh habitats	hurricane storm surge damages to human habitations and loss of estuarine marsh habitats. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: no significant impacts of the NED Plan on soils, water bottoms or prime and unique wetlands.
Sedimentation and Erosion	US & LA & SA: Flood Control Act of 1928 helps reduce sedimentation of rivers and other water bodies caused by erosion associated with agriculture, human development, industrialization and storms. SA: Sediment delivery by Atchafalaya River and other rivers throughout SA.	US & LA: continued sedimentation and erosion associated with agriculture, human development, industrialization, storms, navigation channels and oil and gas canals. LA: 350 miles of sandy barrier shoreline and gulf beaches lost. SA: White Lake average shoreline erosion rate of 15 feet per year; Grand Lake shoreline erosion rate of 11 feet per year to 32 feet per year; and Sabine Lake about 10 feet per year.	US & LA: continued sedimentation and erosion associated with agriculture, human development, industrialization, storms, navigation channels and oil and gas canals. These impacts would be offset by existing and authorized for construction ecosystem restoration projects. SA: continued shoreline erosion and sedimentation.	US & LA: continued sedimentation and erosion associated with agriculture, human development, industrialization, storms, navigation channels and oil and gas canals. These impacts would be offset by existing and authorized for construction ecosystem restoration projects SA: No project-induced impacts of the NED Plan.

(*Alternative 6b– Nonstructural 50 year Floodplain cumulative impacts would be similar in nature but greater in scale compared to Alternative 6a)

US= United States, LA = Louisiana, SA= Study Area

6.8 MITIGATION AND MONITORING PLANS

The CEQ's regulations (40 CFR 1508.20) implementing the procedural provisions of NEPA of 1969, as amended (42 U.S.C. 4321 et seq.) define "mitigation" as including

a) avoiding the impact altogether by not taking a certain action or parts of an action;
b) minimizing impacts by limiting the degree or magnitude of the action and its implementation;
c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and,
e) compensating for the impact by replacing or providing substitute resources or environments.

Because the USACE anticipates there would be no wetland, endangered species, marine mammals, or EFH impacts, it is not preparing a mitigation and monitoring plan.

If the NED Plan changes during design and implementation, the USACE would work with USFWS, NMFS, USEPA, and other interested agencies to develop a final mitigation plan that is fully consistent with the CWA Section 404(b)(1) Guidelines, particularly with respect to the April 10, 2008, mitigation rule. The USACE would issue a special public notice describing the details of this mitigation plan.

Section 7

Recommended Plan

7.1 DESCRIPTION OF THE RECOMMENDED PLAN

The federally RP and NED plan includes nonstructural elevation, dry floodproofing and wet floodproofing measures on a total of 2,240 structures, across the 1,646 square miles of the 0.04 AEP (25-year) storm surge floodplain of the SCCL study area. Coastal storm damages were estimated to be reduced to:

- 1,790 residential structures,
- 233 commercial structures,
- 32 public buildings (including 6 critical infrastructure structures), and
- 185 warehouses.

The reduction in damages would be achieved by elevating residential structures and dry or wet floodproofing non-residential structures. A majority (99 percent) of 1,790 residential structures would be elevated 13 feet above ground surface elevation, with the remaining residential structures elevated to 7 feet.

The following work tasks were assumed for cost estimation purposes on each commercial structure identified for structure elevation:

• Elevation of the structure;

• Raising mechanical equipment (e.g., air conditioner, furnace, water heater, electrical panel, fuel storage, valves, or meters);

• Connecting, disconnecting, and extending utility connections for electrical power, fuel, incoming potable water, wastewater discharge;

• Meeting access requirements of applicable building codes (e.g., stairs with landings, guardrails) or the Americans with Disabilities Act;

• Creating large vent openings in the foundation and walls to meet requirements for floodwater entry and exit;

• In instances where special access improvement (e.g., elevators, lifts, ramps, etc.) may be required (e.g., in the case of physically handicapped or elderly homeowners or occupants) special handicapped access can be considered an eligible improvement when a medical professional/OMV documentation is provided. Multiple access points may also be eligible where necessary to meet state or local building code compliance;

• Removal of any trees which restrict the elevation of a structure;

• Site grading and site restoration including grading landscaping to it preconstruction condition;

• Temporary site protection measures during site work;

• Allowable relocation assistance funds for displaced tenant in accordance with the Uniform Relocation Assistance (URA) and Real Property Acquisition Policies for Federal and Federally Assisted Programs of 1970, Public Law 91-646, 84 Stat. 1984 (42 U.S.C. 4601), as amended by the Surface Transportation and Uniform Relocation Assistance Act of 1987, Title IV of Public Law 100-17, 101 Stat. 246-256. Relocation assistance for tenants may include, among other thing, advisory services, differential housing payments, and reimbursement of costs of moving personal property, rental assistance to supplement the costs of leasing a comparable replacement dwelling, or down payment assistance to purchase a replacement dwelling. Landowners whose properties are voluntarily elevated would not be eligible for benefits in accordance with URA; however, tenants of these structures may be eligible for these benefits.

The following work tasks were assumed for cost estimation purposes on each commercial structure identified for dry floodproofing:

- Dry floodproofing of the structure
- Installation of backflow valves;
- Closures on doors, windows, stairwells and vents-- temporary or permanent;
- Rearranging or protecting damageable property--e.g., relocate or raise utilities;
- Sump pumps and sub-drains;
- Water resistant material; water resistant window coverings, doors and jambs; waterproof adhesives; sealants and compounds, and floor drains;
- Plastic sheeting around the walls;
- Meeting access requirements of applicable building codes (e.g., stairs with landings, guardrails) or the Americans with Disabilities Act;
- In instances where special access improvement (e.g., elevators, lifts, ramps, etc.) may be required (e.g., in the case of physically handicapped or elderly homeowners or occupants) special handicapped access can be considered an eligible improvement when a medical professional/DMV documentation is provided. Multiple access points may also be eligible where necessary to meet state or local building code compliance;
- Connecting, disconnecting, and extending, elevating utility connections for electrical power, fuel, incoming potable water, wastewater discharge;
- Removal of any trees which restrict the dry floodproofing of a structure;
- Site grading and site restoration including grading landscaping to preconstruction condition; and
- Installation of temporary site protection measures during site work.

The following work tasks were assumed for cost estimation purposes on each warehouse structure identified for wet floodproofing:

- Wet floodproofing of the structure;
- Engineered flood vents;
- Flood-resistant construction materials such as rigid foam board wall insulation or cement board and molding within the interior of the building,
- Elevation of electric outlets,
- Concrete floor treatment and interior wall and floor sealer/stains;
- Exterior paint coatings;
- Sand/water blasting or other manual removal of rusted coatings and application of epoxy coatings;
- Meeting access requirements of applicable building codes (e.g., stairs with landings, guardrails) or the Americans with Disabilities Act;
- Connecting, disconnecting, and extending utility connections for electrical power, fuel, incoming potable water, wastewater discharge;
- Elevation of utilities;
- Removal of any trees which restrict the elevation of a structure;
- Site grading and site restoration including grading landscaping to preconstruction condition; and
- Temporary site protection measures during site work.

During implementation each structure would be individually surveyed. Participation in the NED RP is 100 percent voluntary. The expected average annual net benefits are approximated at $14 million dollars, with a fully funded Total Project Cost of approximately $1,334,413,000. The project first cost, estimated cost escalated to the current program year effective price level (FY22), is $914,769,000 (Figure 7-1).

Methods for scheduling or prioritizing nonstructural elevation work, described in Appendix K: Implementation Plan, may include:

- Clustering-If numerous property owners in a contiguous neighborhood or subdivision agree to participate, that particular area could be targeted for priority in structure elevation implementation. A focus on clustered properties can create a ranking hierarchy of which properties to address first. The size of a cluster would need to be defined but could consist of zip codes or neighborhoods. This approach would rank efficiency as the main factor in determining which eligible properties should be prioritized.

- Clustering Based on Low-income or Environmental Justice Communities -The methodology would identify populations that are exposed to high levels of environmental stressors and are low-income or minority populations within the project area using up-to-date economic statistics, aerial photographs, and U.S. Census Bureau 2013-2017 American Community Survey (ACS) estimates. EPA has developed a new environmental justice (EJ) mapping and screening tool called EJSCREEN, which is based on nationally consistent data and an

approach that combines environmental and demographic indicators in the form of EJ indexes. EJSCREEN relies on the 2013-2017 ACS 5-year summary file data. This approach would rank environmental and demographic data as the main factor in determining which eligible properties should be prioritized.

- Risk-Level-Willing property owners may not exist in clusters. In such cases, an alternative option is to focus on the willing property owners that exhibit the highest risk for flood damages. For example, if 1,000 property owners execute Floodproofing Agreements, the owners who reside in the 0.5 AEP floodplain would be prioritized for construction. Once these properties are elevated, the next highest-risk properties (0.2 AEP floodplain) would be targeted. This approach would rank risk exposure as the main factor in determining which eligible properties should be prioritized.

- First-Come, First-Serve-This approach would involve creating a list of eligible property owners and ranking them by how quickly their contracts and eligibility documentation are processed. This approach would help ensure that resources would be used effectively by focusing on properties that have owner support for the floodproofing measures.

Scheduling and prioritization of elevation and wet floodproofing on structures is subject to the availability of Federal funds. Implementation methods will be further investigated during PED.

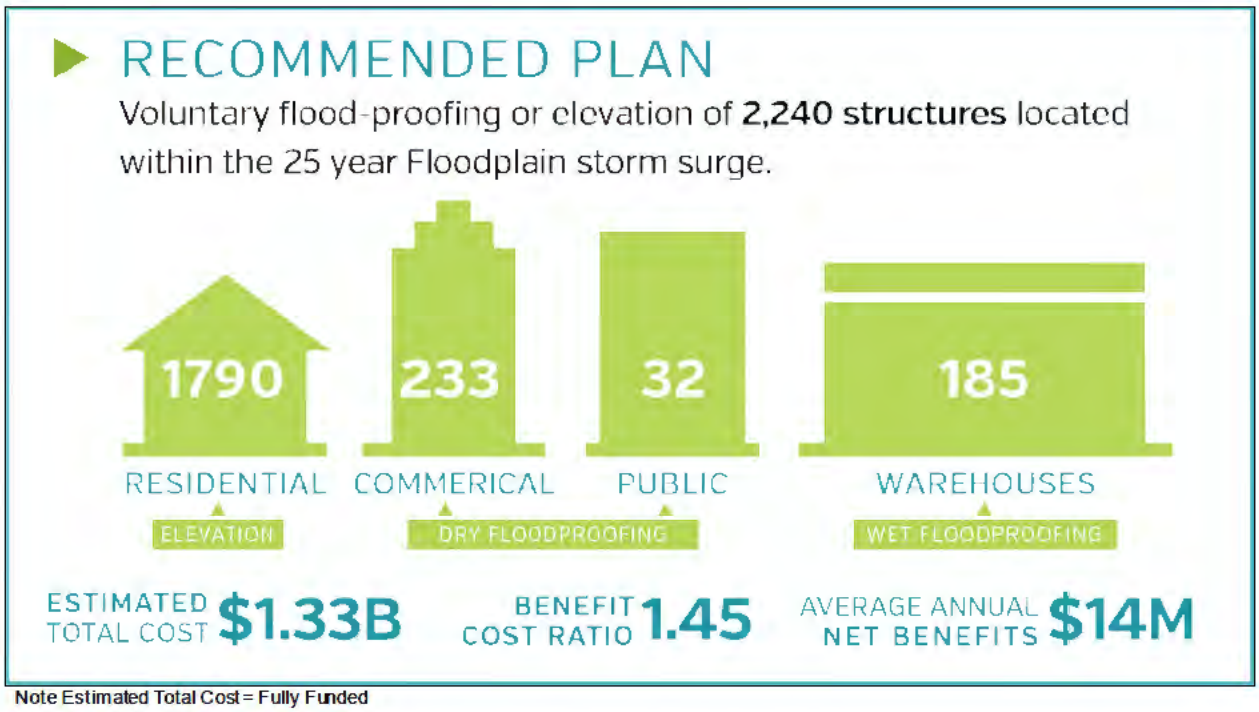


Figure 7-1. Recommended Plan

OMRR&R costs associated with wet floodproofing measures, included in the RP, are painting of building envelope once in the 50 year planning horizon and inspections by the NFS. O&M costs associated with Recommended Plan are presented in Table 7-1. Annualized OMRR&R over the 50-year period is $386,000.

Table 7- 1. Recommended Plan OMRR&R Cost Summary

	Hours	Cost per Hour	Cost per Year
Building Envelope Labor	24	$30.0	$720
Paint Materials (Assumed 20% of labor)	N/A	N/A	$144
NFS/CPRA inspections - Allow 1 day (8 hrs) at $150/hr including transportation.	8	$150.00	$1,200
		Annual Cost Per Structure	$2,064

When the economic activity lost in a flooded region can be transferred to another area or region in the national economy, these losses cannot be included in the NED account. However, the impacts on the employment, income, and output of the regional economy are considered part of the RED account. The input-output macroeconomic model RECONS can be used to address the impacts of the construction spending associated with the project alternatives. The RECONS model utilizes a total construction cost of a project that is attributable to contracts being awarded to complete the construction of the project. This cost excludes USACE labor associated with planning, engineering, and design, as well as economic costs like interest during construction. The costs also include real estate and cultural resources costs since these disbursement of federal funds are expected to be spent within the region of the study area. An example of this would be using Uniform Relocation Act funding to pay a tenant to temporarily relocate to a hotel while their home is being elevated.

The total cost input into the RECONS model for the recommended NED plan was $871,344,000 which again excludes PED, construction management, and interest during construction (IDC). Since there was no nonstructural option within RECONS to classify the construction activity, the spending profile was modified to put more weight on the rehabilitation of structures and less weight on water resource infrastructure. Of this the total expenditures identified, 79 percent would be captured within the local study area. The remainder of the expenditures would be captured within the state or national level. These direct expenditures generate additional economic activity, often called secondary or multiplier effects. The direct and secondary impacts are measured in output, jobs, labor income, and gross regional product (value added) as summarized in Appendix D - Economics Table D:9-1. The regional economic effects are shown for the local, state, and national impact areas. In summary, the nonstructural expenditures of $871,344,000 support

a total of 9,975 full-time equivalent jobs, $549,844,110 in labor income, $648,709,975 in the gross regional product, and $1,074,837,864 in economic output in the local impact area. More broadly, these expenditures support 15,648.8 full-time equivalent jobs, $1,013,182,652 in labor income, $1,365,481,104 in the gross regional product, and $2,296,339,206 in economic output in the nation due to the multiplier effect. Table D:9-2 shows specific regional impacts to specific industries that are related to nonstructural activities.

7.2 RISK AND UNCERTAINTY

Risk is a situation or event where something of value is at stake and its gain or loss is uncertain. Risk is expressed as the probability or likelihood and consequences of an event for an outcome. Consequences can be expressed in terms of harm to people, cost, time environmental harm or property damage (ER 1105-2-101). Uncertainty refers to the likelihood an outcome results from a lack of knowledge about critical elements or processes contributing to risk or natural variability in the same elements or processes. Throughout project planning, the USACE identified risk and uncertainty using collaboration with stakeholders and a risk register. Risk informed decisions were made regarding the reliability of estimated benefits and the costs of the RP. Risks and uncertainty associated with the recommended alternative are described below.

For nonstructural measures, the level of risk reduction is variable, as every structure in the aggregation has a unique ground surface elevation and structural attributes such as foundation height, value, and condition. Each of these factors led to each individual structure, in the project area, having a different level of risk reduction relative to its neighbors and other structures in the inventory. The result is that the Recommended Plan do not have a single level of risk reduction, but rather 2,240 different levels. The level of risk reduction can be summarized by how many structures see risk reduction for each of the eight flood frequencies ran through HEC-FDA, see Appendix D- Economics for additional discussion on the risk reduction.

The recommendation to elevate most residential structures 13 feet would ensure that it would be infeasible to further elevate the structure in the future. Ensuring that structures would be raised to an elevation that exceeds the BFE would also assist maintenance of affordable housing and neighborhood cohesion. Elevation of 99 percent of residential homes 13 feet above ground surface elevation would raise some homes 3-5 feet above the BFE, potentially

IMPORTANT TERM

ANNUAL EXCEEDANCE PROBABILITY (AEP)

The percent chance of a particular storm event being exceeded in any one year.

A 0.01 AEP has 1% chance or 1 in 100 chance occurring in any one year.

That ***same*** 0.01 AEP storm event has a **9.6% chance of occurring in any 10 year period.**

0.01 AEP can be considered equivalent to the 100 year storm event.

reducing insurance costs at the on-set of the mitigation reflecting the additional risk reduction provided.

Wet floodproofing warehouse structures could mitigate storm surge flooding up to 12 feet to a warehouse structure.

Residential structures being elevated 13 feet above ground surface elevation have the highest level of risk reduction in the study area, especially those located more inland on higher ground surface. The structures with the least level of risk reduction are those receiving dry floodproofing, where the mitigation has a ceiling of 3 feet and therefore only mitigates the highest frequency of events.

The Recommended Plan shows fifty percent of structures in the inventory have risk reduction that exceeds the existing condition (2025) 0.002 AEP level as a result of being elevated. Fifty-nine percent of structures in the inventory have risk reduction that exceeds the existing condition (2025) 0.01 AEP level as a result of being elevated and wet floodproofed. The rest of the inventory, has risk reduction less than the 0.01 AEP level.

Within the entire study area, the Recommended Plan would reduce residual damages for year 2025 by 17 percent. This figure is for the entire study area, which encompasses thousands of additional structures not included within the 2,240 structures in the 0.04 AEP nonstructural aggregation. When calculating residual risk for just the nonstructural aggregation, the Alternative 1 would reduce year 2025 damages by 27 percent, meaning 73 percent of the existing condition damages would remain within the 0.04 AEP nonstructural aggregation with project implementation.

Structure elevations and floodproofing design performance was analyzed for three RSLR scenarios: low, intermediate, and high the following results:

- RP design heights would provide benefits (damage reduction) throughout the study area beyond 80 year project life under the low RSLR rate;
- RP design heights would provide benefits (damage reduction) throughout the study area beyond a 50 year life under the intermediate RSLR rate;
- RP design heights would provide benefits (damage reduction) throughout the study area for 25 year life under the high RSLR rate.

Figure 7-3 illustrates the performance of the design elevations (0.04 at 2075) over a 100 year intermediate RSLR scenario. Additional RSLR projections and analysis details are presented in Appendix C: Hydraulics and Hydrology and Climate Preparedness and Resiliency Section 6. Due to design constraints including 12 feet of wet floodproofing and 13 feet above ground surface elevation, nonstructural measures within the recommended plan are optimized. Design modification to Recommended Plan measures are highly unlikely to result in an additional damages reduced under a high RSLR scenario. In the event the high RSLR scenario is experienced reformulation of the recommended plan may be warranted.

Life safety assessment of the SCCL RP was completed on the primary evacuation route (Hwy 90). Full assessment details are described in Appendix D Economics Section 8 Life Safety. The assessment identified locations of frequent inundation.

Two locations were identified to be most at risk near Amelia and Franklin communities (see Figure 7-2). Depths of road segments around Amelia during a 0.05 AEP (20 year) event are shallow enough that cars could still evacuate. Events such as the 0.02 AEP (50YR) and 0.01 AEP (100YR), flooding depths are high enough to impede evacuation efforts. Structures in the Amelia area are primarily commercial and industrial, during a large storm event would likely have enough lead time for business operations to send workers home ahead of time, and therefore not pose a significant risk to life safety.

The most floodprone stretch of US-90 is near Franklin, LA. Depths during the 0.05 AEP event exceed the road elevation by 3 to 5 feet. During a 0.05 (20YR) or 0.02 (50YR) event, low-clearance vehicles driving along US-90 toward Franklin, or originating in Franklin, would likely have to detour further inland to one or two-lane roads, slowing evacuation egress. Estimates of floodwater velocities are uncertain for the SCCL study area, and therefore it is unknown if cars caught by floodwaters on US-90 near Franklin would be swept off the road. Given flood depths exceeding 3-5 feet, velocities of at least 0.66-1 feet per second would be enough to lead to the potential for life loss for low-clearance vehicles evacuating through Franklin. The constraint at Franklin could be an issue for the communities of Franklin, Centerville, Calumet, Bayou Visa, and portions of Morgan City.

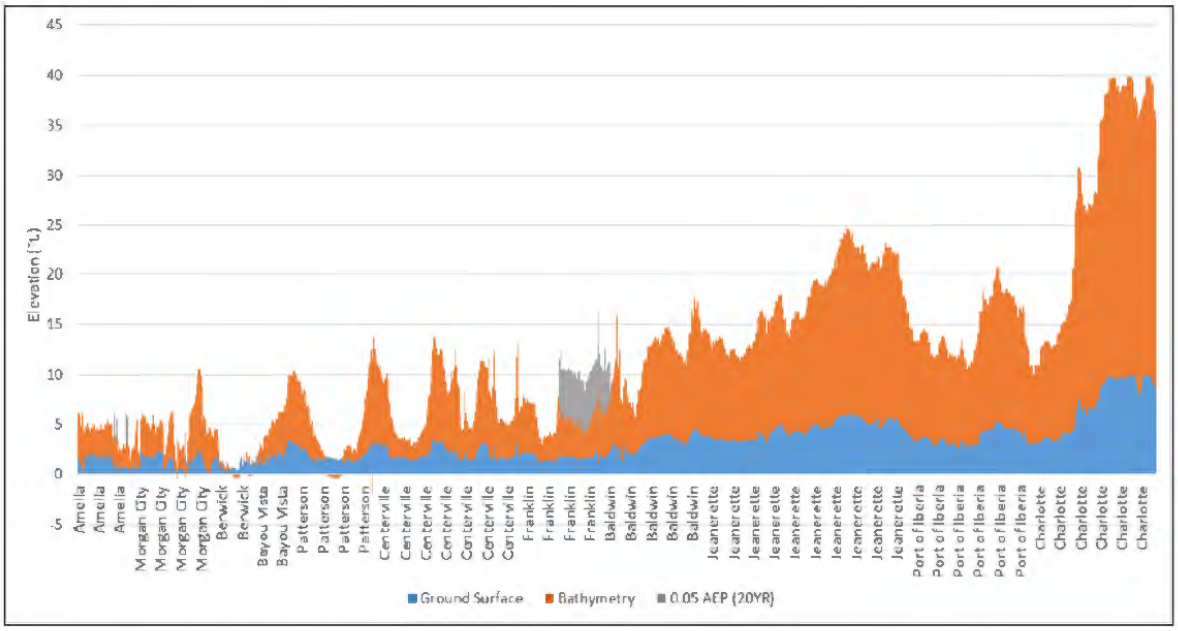


Figure 7-2. Hwy-90 Elevation Profile with 0.05 AEP (20 YR) Flood Depth

FRM is a shared responsibility between local, state, and federal entities. Active floodplain management can greatly reduce flood and life safety risk, residual risk

remains requiring Emergency Operations Planning. Current EOPs support the nonstructural plan by outlying additional flood risk reduction measures that are employed during storm events such as warnings and evacuation activities. The RP does not reduce flood depths on HWY-90 and does not provide additional risk reduction for those evacuating. Under a high RSLR flood depths and inundation frequency would worsen. Inundation depths under high RSLR scenarios are shown in Appendix C, Hydraulics, Hydrology, and Climate Preparedness and Resiliency. It is recommended that local and state official evaluate the potential impacts of RSLR on evacuation routes to determine if changes to storm warning and evacuation activities is warranted.

Alternative 1, with content protection measures described in Section 4.5 of this report would further reduces residual risks. Through collaboration with non-federal partners and in consideration of other study and stakeholder interests, further analysis was conducted on content protection measures (CPM) for the 185 warehouses within the study area. The results of the analysis produced candidate measures that could not be implemented by the Corps of Engineers, but could be implemented by other Federal, State or local entities. These measures included multiple methods to raise the contents above 6 feet to reduce the damages. USACE partnered with the Association of State Floodplain Management (ASFPM) and the Flood Mitigation Industry (FMI) to develop generic cost estimates for CPM within warehouse structures. Estimates of content protect measure costs and benefits were developed. These estimates indicate that these measures would have a positive Benefit to Cost Ratio and could reduce the residual damages by approximately 40 percent.

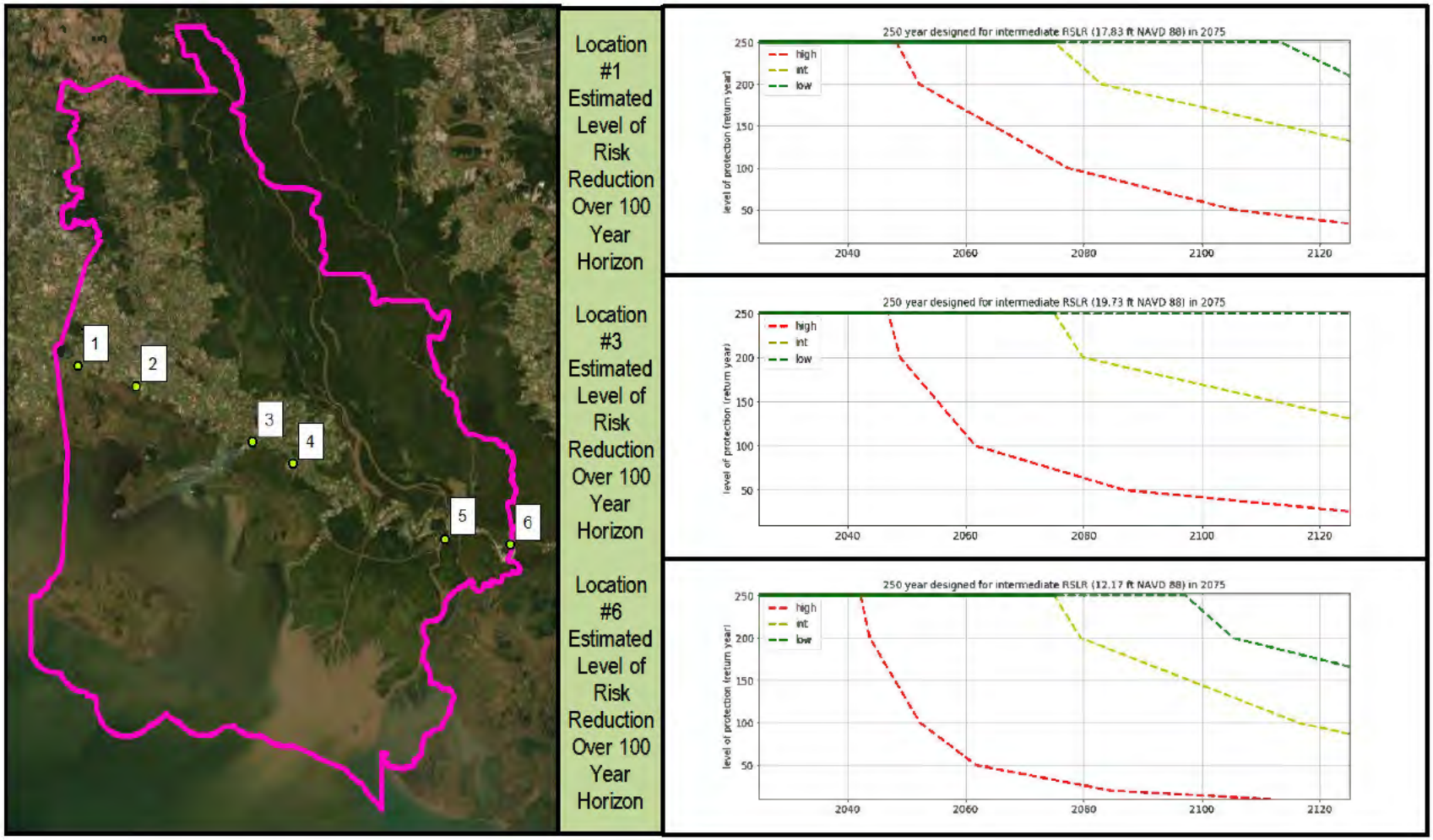


Figure 7- 3. Recommended Plan Estimated Level of Risk Reduction over 100-Year Horizon

Measures were developed to manage risk, expanding on and referencing successful similar work completed by previous projects along the Louisiana coast as well as nationwide. Future design elevations were maximized based on benefit accrual and design constraints. Experience from previous projects helped in the identification of possible risks and decrease uncertainty in plan formulation. No single measure or alternative in the Recommended Plan is burdened by significant risk or uncertainty regarding its eventual success. Significant risks were avoided by using proper design, appropriate selection, and lessons learned from similar nonstructural efforts. Risks were also managed through extensive coordination with other agencies and USACE experts. The dynamic and complex nature of coastal environmental processes is a principal source of uncertainty.

Communities within the study area cannot change the minimum NFIP standards, the NFS should work with the local governments to adopt local standards that achieve higher levels of flood risk reduction, such as replacing elevation requirements based on the 0.01 AEP to the 0.002 AEP level of risk reduction; implementing a zero rise floodway; and adopting cumulative damages as the trigger for substantial damage determination. Local governments within the floodplain should be encouraged to adopt and implement and enforce stricter building and housing code requirements, and land use and zoning regulations and other developmental controls aimed at reducing flood risk and flood damage.

7.3 ENVIRONMENTAL FACTORS

Environmental impacts Recommended Plan are not significantly different therefore for the purposes of this section description apply to both alternatives.

7.3.1 Coastal Wetlands and Other Environmental Resources/Habitats

Factors beyond the scope of this study would continue to impact natural resources like RSLR and development, but an increase of environmental risk from environmental degradation based on the RP is low. The RP would not impact natural habitats or other important resources in the planning area. The RP would not require any wetland or other types of mitigation.

Exposure to contaminanted sediment and debris would continue from the RP, but a the same or lower levels that exist today. Advances in clean up technology and increased regulations should reduce any toxic exposure.

Low risk would still exist for cultural resources. Approximately 450 known cultural sites are within the project area. A significant amount of the project area has not been surveyed. At the present time, the USACE cannot fully determine how the Undertaking may affect historic properties, the location of historic properties, or their significance and character [36 CFR 800.14(b)(1)(ii)]. Therefore, prior to approving the Undertaking, the

agency developed a project-specific PA, pursuant to 36 CFR 800.14(b), and in consultation with stakeholders in furtherance of USACE s Section 106 responsibilities for this Undertaking (Appendix A-3). The implementation of the PA would greatly reduce cultural resource impacts and risk.

7.4.2 Relative Sea Level Rise

There is uncertainty about how much sea level change would occur in the region. The evaluation of RSLR is documented in Appendix C, Hydraulics, Hydrology, and Climate Preparedness and Resiliency. Calculations based on Engineering Regulation 1100-2-8162 determined the low, intermediate, and high rates of RSLR at 2075 1.3, 1.8, and 3.4 feet higher for the low, intermediate, and high cases. The intermediate rate was used for models and screening alternatives, with the low and high rates then used in a sensitivity analysis on the RP to ensure that no superior alternatives had been accidentally eliminated due to the reliance on a single scenario. This analysis is detailed in Appendix C: Hydraulics, Hydrology, and Climate Preparedness and Resiliency.

The RSLR could impact the benefits achieved by the RP. Because the RP was developed using the intermediate RSLR rate, the RP would provide fewer benefits than anticipated should the low RSLR rate result and more benefits with the high RSLR rate. With the high RSLR rate, the nonstructural component would be less effective because structures would have to be raised to a height that would increase their risk from wind damage during a storm. For those structures already raised in a previous round of elevation, actual economic benefits could be lower than anticipated if community cohesion and supporting infrastructure are not maintained. These factors would be considered during the implementation phase of the Project. The USACE would continue to monitor local conditions and determine if the intermediate scenario of RSLR is occurring. If observed conditions deviate from intermediate to high sea level forecasts during design or construction, actual NED benefits vary.

7.4.3 Storms

Uncertainty with regard to the size and frequency of hurricanes resulting from global meteorological events, such as El Nino and La Nina, cannot be predicted over a set period of time. The storm record is constantly being updated and a large storm such as Hurricane Rita or a slow moving storm such as Hurricane Isaac can alter the expected return period for other storms. To reduce the uncertainties of storm events, storms with varying degrees of size, intensity, and path were included in the modeling. By using a long-term record of different storm scenarios, the effects of such storms were incorporated into the modeling to reduce the uncertainty in the determination of Project benefits (see Appendix C- Hydraulics, Hydrology, and Climate Preparedness and Resiliency).

If indicated by monitoring of RSLR and/or climate non-stationary, the nonstructural project can be adaptive and make adjustments to design criteria and structures

preliminarily recommended for inclusion in the project. This is achievable because the implementation of a broad regional nonstructural project, as well as evidence of a greater-than-predicted rate of RSLR and/or coastal storm damages, would be distributed over time. As sea level changes and is updated over time, the floodplain definitions would change, design criteria can be adapted and the predicted 2075 0.004 AEP BFE could be adjusted upward. This could require raising structures deemed eligible in the RP to a higher elevation (only if not initially determined eligible or if not already elevated to the 13 foot maximum of 99 percent of eligible structures) than identified at this time or inclusion of additional structures eligible for wet or dry floodproofing. Conversely, some elevated structures would return to the risk pool earlier than forecasted if the actual RSLR is more consistent with the high rate rather than the predicted intermediate RSLR. However, this would also be a time distributed effect and identification of greater than expected RSLR would correspond to a potential reduction of forecast benefits.

7.5 MODELING FACTORS

The ADCIRC and HEC-RAS models appear to provide a specific response on the RP in any given scenario; however, it is only a representative point of reference in a complex system. While the analysis is enhanced by the models, application of the models can introduce error and uncertainty. Calibration and verification efforts are employed so the models more closely replicate observed changes or at least provide insight into the limitations of the model. Models are limited by basic, underlying assumptions and uncertainties. Some of the simplifying assumptions include the model parameters such as boundary conditions, which are limited by the data available, especially during storm events and the time period selected for analysis. Another model parameter assumption is model geometry. Survey data/LiDAR has good coverage in some areas; other areas require assumptions, interpolations, extrapolations, or known elevation points to get coverage. Another uncertainty is that a limited number of storm scenarios are modeled. The USACE assumed various storm scenarios over a number of years would represent a much higher indicator of the ability for nonstructural measures to appropriately avoid or minimize surge related damages from major storm events. Models use available historic data to extrapolate future storm conditions and frequency. The size and frequency of storms included are based on statistical analysis, but do not account for meteorological changes that can increase or decrease storms over a period of several years. The models do not account for the potential of increased frequency and intensity of storms due to climate change.

7.6 ECONOMIC FACTORS

To ensure that the economic damages reduced reasonably maximize net benefits, all factors that could be optimized in support of the Recommended Plan were analyzed. These factors include the nonstructural aggregation, residential elevation height, and non-residential floodproofing effectiveness.

The USACE used an economic model to analyze the existing condition and with project measures (Appendix C: Hydraulics, Hydrology, and Climate Preparedness and Resiliency). The with-project alternatives were run to the point of producing the structure detail and therefore do not include any risk and uncertainty in the results.

The equivalent annual damage HEC-FDA computations resulted in 9 reaches within the SCCL study area with more than $5 million in equivalent average annual damages per reach. The Recommended plan still reduces damages by more than 50 percent in many of the reaches, but less so for the areas with heavy industrial warehouse concentrations, such as the Port of Iberia since contents are not mitigated. Of the reaches that were not benefited by Recommended Plan, all currently receiving reduced coastal storm flood risk from an existing levee system, meaning damages are occurring during flood events less frequent than the 0.01 AEP event, or the risk reduction offered by the levee system becomes less effective for HEC-FDA simulations sampled closer to the future SLR condition.

The HEC-FDA computed upper and lower bounds to show the uncertainty associated with damages reduced. For the Recommended Plan, there is a 25 percent chance that benefits would exceed $61.2 million equivalent annual damages and a 75 percent chance that benefits would exceed $26.7 million equivalent annual damages.

7.7 FEDERAL AND NON-FEDERAL COST-SHARING

The State of Louisiana acting through the CPRAB would be the NFS for design, construction, operation, maintenance, repair, rehabilitation and replacement. It is anticipated the cost share for the design and construction of the project would be 65 percent Federal and 35 percent non-Federal. However, Public Law 115-123 provides that a project that is studied using Supplemental Investigations funds is eligible for implementation using Construction funds provided in that Act if the Secretary determines that the project is technically feasible, economically justified, and environmentally acceptable. Final, specific cost share requirements would be identified in the Project Partnership Agreement. Among other responsibilities, the CPRAB must provide all project LERRDs required for the project. The OMRR&R cost is a 100 percent NFS responsibility.

The estimated total project cost for the RP is $1,334,413,000 (FY 2022 price level). Based on the project first cost of $914,769,000 the NFS investment is estimated at $320,169,150 and the Federal investment estimated at $594,599,850. Table 7-2 contains a summary of estimated costs and benefits for the Recommended Plan. Table 7-3 contains a summary of cost apportionment and cost breakdown between Federal and NFS. Costs are based on 100 percent participation rate. Actual participation rate may be lower.

Table 7- 2. Recommended Plan Cost Summary

Risk Reduction Measure	# of Structures	Cost
Structure Elevation	1,790	$373,096,000
Dry Floodproofing	265	$ 35,281,000
Wet Floodproofing	185	$102,905,000
Total (Rounded)	2,240	$511,282,000
Percent Applied		
Contingency	31.4%	$162,076,000
Cultural Resource Preservation	NA	$14,723,000
Real Estate	NA	$41,145,000
Planning, Engineering and Design	5%	$117,972,000
Construction Management	2%	$65,540,000
Interest During Construction (IDC)	$2,031,000	
Total Project Cost (Fully Funded)	$1,334,413,000	
Project First Cost (FY22)	$914,769,000	
Average Annual Cost	$31,048,000	
Equivalent Annual Damage Reduced	$45,130,000	
Net Benefits	$14,082,000	
BCR	1.45	

* Costs are rounded to the nearest thousand.

* Project first cost was updated with new IDC after Cost Certification received March 2nd 2022

Table 7-3. Cost of the Recommended Plan Cost Apportionment (Project First Cost w/o IDC)

DESCRIPTION	COST	Contingency	Contingency Cost	Project First Cost
Raising and Floodproofing	$511,280,000	31.70%	$162,076,000	$673,358,000
Cultural Resource Preservation	$11,179,000	31.7	$3,544,000	$14,723,000
Lands and Damages	$32,916,000	25%	$8,229,000	$41,145,000
Planning, Engineering and Design (5%)	$89,577,000	31.70%	$28,396,000	$117,972,000
Construction Management (2%)	$49,765,000	31.70%	$15,775,000	$65,540,000
			TOTAL:	$914,769,000
			Local Cost Share(35%)	$320,169,150
			Government Share (65%)	$594,599,850

The RP would be implemented over a 20 year period. Construction duration per structure is estimated at 3 months. A total of 2,240 structures included in the RP would require elevation, wet floodproofing or dry floodproofing methods on 112 structures per year.

No mitigation is required for the RP. The RP does not directly affect Tribal lands.

For nonstructural plans, no change is expected in evacuation behavior because the potential exaggerated expectations of performance afforded to structural measures is not present, and awareness of flood risk is not abated. Similarly, residual risk to critical infrastructure (i.e., hospitals, evacuation routes, public buildings) is not expected to be different from without-project conditions since much of this infrastructure is already built and designed to operate in dire situations, especially those of greater frequency such as tropical systems and flood potential. Elevated structures would meet structural stability requirements per local code. Parish Emergency Management Plans and Evacuation procedures, including trigger points, would be implemented across the geographic area

and adherence to evacuation is not anticipated to change. As a result of structure elevation life safety risk reduction is expected to have minor positive impacts. Life safety risk reduction is specific to residents who shelter in place and during events not requiring evacuation.

7.8 PARTICIPATION RATE

A unique cost estimate was provided for each of the participation rates utilized in the analysis, and it was assumed the Recommended Plan to represent the 100 percent participation rate. The sensitivity analysis for the participation rate identified no significant change to the overall BCR since both benefits and costs decreased proportionally. While the overall BCR does not change with a lower or higher participation rate than the estimated 65 percent, the net benefits decrease significantly as participation rates decrease (thereby increasing residual damages).

The determination of a 65 percent participation rate was based on a variety of factors including:

- How often the study area experiences coastal storm events that have the potential to cause structural damages,
- The likelihood that the study area has structures that are safe, sanitary, and free from HTRW,
- The ability of homeowner or tenets to temporarily relocate during construction (elevation, dry floodproofing or wet floodproofing), and
- Demographic statistics.

This project would need to have a strong public outreach component to help educate these communities on the long-term benefits of flood risk mitigation to be successful and live up the expected 65 percent participation rate. Additionally, details on participation rate analysis can be found in Appendix D: Economics.

A unique cost estimate was provided for each of the participation rates utilized in the analysis, and it was assumed the recommended NED plan to represent the 100 percent participation rate. The sensitivity participation rate analysis identified no significant change to the overall BCR since both benefits and costs decreased proportionally. While the overall BCR does not change with a lower or higher participation rate than the estimated 65 percent, the net benefits decrease significantly as participation rates decrease (thereby increasing residual damages).

Best Case Scenario Participation – 85 percent
Selected: Most Likely Case Scenario Participation – 65 percent
Worst Case Scenario Participation – 50 percent

Although cost estimates for the Recommended Plan was calculated using a 100 percent participation rate, a sensitivity participation rate analysis was completed for best-case

(85 percent), most likely case (65 percent), and worst case (50 percent) scenario participation rates. The sensitivity participation rate analysis identified no significant change to the overall BCR since both benefits and costs decreased proportionally, as shown in Table 7-4.

Table 7-4. Participation Rate Analysis Results

	100% Participation	85% Participation	65% Participation	50% Participation
Total Structures Elevated, Wet, or Dry Floodproofed	2,240	1,911	1,462	1,124
Total Cost	958,518,000	698,684,539	528,812,241	404,489,106
BCR	2.56	2.69	2.55	2.66

7.9 FEDERAL RESPONSIBILITIES

The Federal government would be responsible for PED and construction of the project in accordance with the applicable provisions of Public Law 99-662 (WRDA of 1986), as amended. The government, subject to Congressional authorization, the availability of funds, and the execution of a binding agreement with the NFS in accordance with Section 221 of the Flood Control Act of 1970, as amended, and using those funds provided by the NFS, shall expeditiously construct the project, applying those procedures usually applied to Federal projects, pursuant to Federal laws, regulations, and policies.

7.10 NON-FEDERAL RESPONSIBILITIES FOR THE RP

Federal implementation of the project would be subject to the NFS agreeing in a binding written agreement to comply with applicable Federal laws and policies, and to perform the following non-Federal obligations, including, but not limited, to the following:

a. Provide 35 percent of total project costs as further specified below:

1. Provide the non-Federal share of design costs allocated by the Government in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;
2. Provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs;
3. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands,

easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Government to be required or to be necessary for the construction, operation, and maintenance of the project;

4. Provide, during construction, any additional funds necessary to make its total contribution equal to 35 percent of total project costs;

b. Do not use funds provided by a Federal agency under any other Federal program, to satisfy, in whole or in part, the non-Federal share of the cost of the project unless the Federal agency that provides the funds determines that the funds are authorized to be used to carry out the project;

c. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

d. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

e. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the NFS owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

f. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;

g. Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as would properly reflect total project costs, and in accordance with the standards for financial management systems set in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 CFR Section 33.20;

h. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5), and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the NFS has entered into a written agreement to furnish its required cooperation for the project or separable element;

i. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army" and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c et seq.);

j. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the NFS with prior specific written direction, in which case the NFS shall perform such investigations in accordance with such written direction;

k. Assume, as between the Federal Government and the NFS, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project;

l. Agree, as between the Federal Government and the NFS, that the NFS shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that would not cause liability to arise under CERCLA.

m. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities

which might reduce the level of risk reduction the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function;

n. Not less than once each year, inform affected interests of the extent of protection afforded by the project;

o. Agree to participate in and comply with applicable Federal floodplain management and flood insurance programs;

p. Comply with Section 402 of the WRDA of 1986, as amended (33 U.S.C. 701b-12), which requires a NFS to prepare a floodplain management plan within one year after the date of signing a project partnership agreement, and to implement such plan not later than one year after completion of construction of the project;

q. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

r. Shall not use any project features or lands, easements, and rights-of-way required for such features as a wetlands bank or mitigation credit for any other project;

s. Pay all costs due to any project betterments or any additional work requested by the sponsor, subject to the sponsor's identification and request that the government accomplish such betterments or additional work, and acknowledgement that if the government in its sole discretion elects to accomplish the requires to so notify the NFS in writing that sets forth any applicable terms and conditions.

t. The NFS is required to prepare a Floodplain Management Plan to maintain the integrity of the project. However, the NFS should work with the governing bodies within the three parishes to ensure consistency with local development plans and regulations.

7.11 SUMMARY OF FINDINGS

The USACE identified Alternative 1, elevation of residential structures, wet floodproofing industrial structures and dry floodproofing of commercial and public structures within the 25 year storm surge floodplain as the RP for authorization as a Federal project, with such modifications thereof in the discretion of the Commander, Headquarters, U.S. Army Corps of Engineers. The USACE recognizes the NFS, CPRAB, supports the current identification of the RP.

Information in this document was developed for feasibility analysis, with input from Federal agencies, local governments and comments from the public, to help refine potential solutions to coastal storm risk within South Central Coast study area. Public involvement is an important part of the planning and decision-making process.

A Notice of Availability for the Final Supplemental FR/EIS was published in the Federal Register and circulated for a 45 day public review period to Federal, state, and local agencies, non governmental and other organizations and individuals who have an interest in the project. All comments received during the public review were considered and incorporated into the Final Supplemental FR/EIS as appropriate.

A Notice of Availability of the Final Supplemental FR/EIS would be published in the Federal Register and available for 30 days. All comments received during this period would be considered prior to USACE making a final decision on the RP and in preparing the ROD.

The recommendation contained herein reflects the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding.

STEPHEN F. MURPHY
Colonel, Corps of Engineers
District Commander